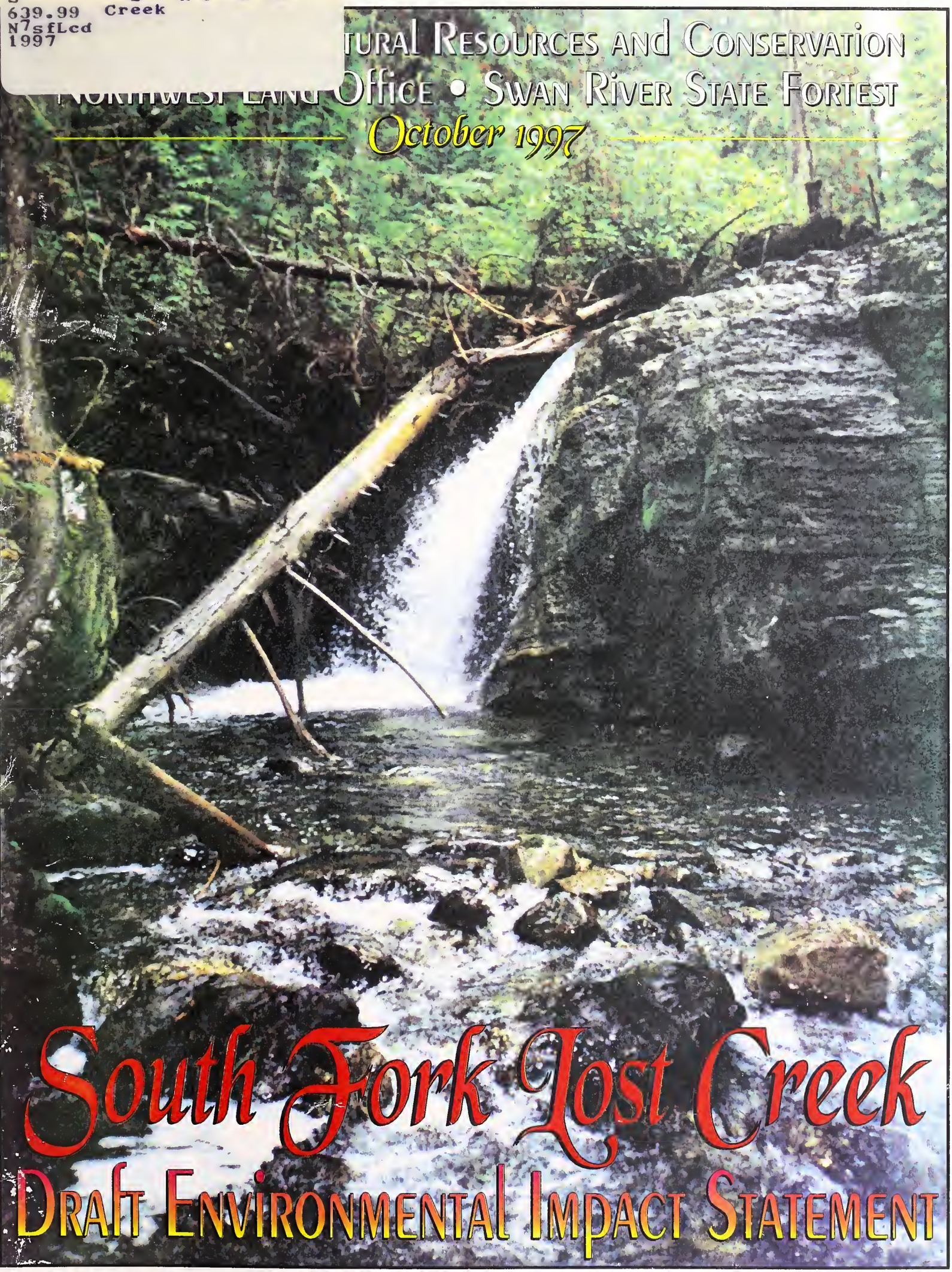
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South Fork Lost Creek

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October 1997



South Fork Lost Creek

Draft Environmental Impact Statement

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COVER PHOTO: *Falls on the South Fork Lost Creek, not included in any proposed harvest unit.*

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SUMMARY

DRAFT ENVIRONMENTAL IMPACT STATEMENT FOR THE SOUTH FORK LOST CREEK PROPOSED TIMBER SALE

PROPOSED ACTION

Swan River State Forest (SRSF) proposes to harvest approximately 10 MMBF of timber in the South Fork of Lost Creek drainage. SRSF is a branch of the Montana Department of Natural Resources (DNRC). The project area is located approximately 4 miles southeast of Swan Lake, Montana, and includes three full sections and portions of eight others in T24N-R17W, for a total of approximately 4,306 acres. If a harvest alternative is selected, 626 to 695 acres would be harvested through various silvicultural treatments intended to simulate natural ecological processes. The SRSF Stand Level Inventory was screened to identify stands classified at risk and recommended for harvest

PURPOSE

The proposed harvest of about 10 MMBF of timber is intended to improve the health of the forest and generate funding for the Montana School Trust Fund. The land involved in this proposed project is held by the State of Montana in trust for the support of public schools (Enabling Act of February 22, 1889; 1972 Montana Constitution, Article X, Section 11). DNRC and the State Board of Land Commissioners (Land Board) are required by law to administer these trust lands to produce the largest reasonable and legitimate return over the long run (Section 77-1-202, MCA).

THE AFFECTED ENVIRONMENT

The South Fork Lost Creek project area is located in the northeast corner of the Swan River State Forest approximately 4 miles southeast of Swan Lake. The 4,306 acres in the project area range in elevation from 3,360 feet where the South Fork of Lost Creek leaves the project area to 7,238 feet at the crest of an un-named peak on the southeastern boundary. The project area consists of a steep, narrow, uninhabited canyon with rocky cliffs, limited access, avalanche chutes, heavy-timbered slopes, subalpine terrain and riparian areas along the South Fork of Lost Creek and small feeder streams.

Game animals inhabiting the project area at least part of the year include mule and white-tailed deer, elk, moose, and black bear. The draft EIS addresses four wildlife species that are on the U.S. Fish and Wildlife Service endangered species list: grizzly bear, wolf, bald eagle, and peregrine falcon. Of these, only the grizzly bear is known to inhabit the project area at least part of the time.

The State Forest Land Management Plan (SFLMP 1996) directs DNRC to give special consideration to sensitive species when conducting forest management activities. These species are sensitive to human activities or have special habitat requirements that may be altered by timber management, or may become listed under the federal Endangered Species Act unless management can improve their long-term prospects. Sensitive species that might be affected immediately or in the future by the proposed project include the black-backed woodpecker, western big-eared bat, boreal owl, fisher, lynx, and pileated woodpecker.

PLEASE RETURN

Old growth forest covers about 59 percent (2,387 acres) of the project area. Old stand patch sizes in the project area average 298 acres. Tree species represented include Douglas-fir, western larch, cedar, white pine, and ponderosa pine. Old-growth is defined as trees at least 150 years old. Old forests of western larch/Douglas fir and cedar predominate in the lower elevations. These forests contain scattered old ponderosa pine on the south facing slopes at the western end of the project area. Old white pine and younger species in diverse sapling stands are scattered throughout these old, lower-elevation forests. Moving up in elevation, the predominant western larch/Douglas-fir and cedar are interspersed with large proportions of subalpine fir and spruce. In sapling stands at the higher elevations, the predominant subalpine fir and spruce are mixed with a lesser component of western larch, Douglas-fir and white pine. Natural conditions, such as a damp microclimate, and effective fire suppression in the project area have led to a forest that is older and has a greater representation of shade-tolerant species than would occur under average historical conditions elsewhere in the region. The potential for large catastrophic fires and increased loss to insects and diseases is high.

Westslope cutthroat trout and bull trout are species of special concern found in the South Fork of Lost Creek. Impacts to these fish probably would be avoided by compliance with the SMZ rules and the "immediate Actions for Bull Trout Recovery" agreed to by DNRC and the Governor's Bull Trout Recovery Team in 1994. Monitoring suggests that the water quality of the South Fork of Lost Creek has not been seriously affected by human activity.

Timber Harvest Guidelines

Any timber harvest carried out under this proposal would incorporate guidance from the SFLMP Resource Management Standards, the Swan Valley Grizzly Bear Conservation Agreement (SVGBCA), Best Management Practices (BMP), Streamside Management Zone (SMZ) rules, Flathead Basin Commission recommendations, and other laws, rules and regulations.

DNRC adopted the SFLMP in 1996. The SFLMP outlines DNRC's management philosophy for State forested trust lands, and sets out specific Resource Management Standards for 10 resource categories. The SFLMP states:

> Our premise is that the best way to produce long-term income for the trust is to manage intensively for healthy and biologically diverse forests. Our understanding is that a diverse forest is a stable forest that will produce the most reliable and highest long-term revenue stream.... In the foreseeable future, timber management will continue to be our primary source of revenue and our primary tool for achieving biodiversity objectives.

Planning for the South Fork Lost Creek project started before the SFLMP was adopted, so implementation of the SFLMP was phased into the project as it developed. DNRC made all reasonable attempts to incorporate the philosophy and standards of the SFLMP into this project.

DNRC is committed to the provisions of the Swan Valley Grizzly Bear Conservation Agreement (SVGBCA). Beginning in December 1994, DNRC participated with the U.S. Fish and Wildlife Service (USFWS), Flathead National Forest (FNF), and Plum Creek Timber Company in the development of the SVGBCA (USFWS 1995b). The SVGBCA seeks to achieve cooperative management of grizzly bear habitat in the Swan valley where intermingled ownership patterns and differing land management objectives complicate habitat management for a species as wide-ranging as the grizzly bear. The South Fork Lost Creek project area is within the conservation area delineated in the SVGBCA. The agreement is summarized in Chapter 4.

Public Concerns

In December, 1994, DNRC solicited comments from the public on the proposed project. Subsequently, the public raised concerns about the potential impacts of the project on the environment. These concerns are discussed in Chapter 2 of the draft EIS, and were used in developing alternatives. Among the concerns most important to the public were the potential effects on grizzly bears and old growth timber.

The proposed project would avoid impacts to grizzly bears through adherence to the SVGBCA.

Impacts to old growth would be minimized through compliance with the SFLMP, which specifies that DNRC would

"seek to maintain or restore old growth forest in amounts at least half the average proportion that would be expected to occur with natural processes on similar sites."

SFLMP also requires retention of old growth in proportions and on sites to simulate average historical conditions (as determined in large part from historical surveys and subsequent analysis). Any harvesting under the proposed action would comply with these provisions.

Alternatives

DNRC's consideration of alternatives began in 1994 when the proposed action was developed. Public comments led to the development of the four alternatives discussed in the draft EIS: the no-action alternative and three timber-harvest alternatives. The timber harvest alternatives are intended to simulate many of the ecological functions that would result from unsuppressed wildfire and other natural disturbances. The no-action alternative is included as a baseline for comparing the environmental consequences of the three timber harvest alternatives, and is considered a viable alternative for selection. Silvicultural treatments that would go with each timber-harvest alternative would be intended to promote natural patch sizes, shapes, connectivity, structural diversity and species composition. Mitigating measures common to all timber-harvest alternatives are outlined in Chapter 4 of the draft EIS. The silvicultural treatments that would be employed under the alternatives are described in Chapter 2.

Alternative A (No-action)

If this alternative were selected, the proposed timber harvesting would not occur in the project area as described under the other alternatives. Land management activities such as timber harvesting could be proposed and undertaken in the future following the appropriate level of MEPA review. Management activities such as fire suppression and road maintenance would continue. Figure 2.1 shows the project area as it would continue to exist under Alternative A.

Alternatives B, C, and D

All of the timber harvest alternatives would include abandonment of about 1.4 miles of the South Fork Lost Creek road (in Sections 3 and 4 of T23N, R17W) where it runs too close to the creek and constitutes a potential source of sediment. A new, 1.6-mile replacement segment would be constructed approximately 100-200 feet up slope from the existing roadbed.

Alternatives B, C and D focus on specific public concerns that were expressed in comments to DNRC. All the timber harvest alternatives meet the following silvicultural criteria:

- The alternative would provide approximately 10 MMBF of timber.
- Long-term timber productivity would be maintained or enhanced.
- The natural role of wildfire in this area would be simulated through the application of silvicultural treatments to promote natural diversity of stand structure species composition.
- Proposed harvest units would be located adjacent to previously harvested units to create groups of young-age stands, similar to what would occur naturally due to wildfires.
- Road construction would be minimized by location of harvest units and use of logging systems that would require the least amount of road.

ALTERNATIVE B

Alternative B (Figure 2.2) would harvest approximately 9.8 MMBF from 615 acres. This alternative would include construction of 1.3 miles of new road to provide access to units 5, 6, 7, 9 and 10.

This alternative incorporates specific criteria developed to address public comments that the proposed project should maintain wildlife habitat, especially for old-growth-associated species. These criteria were used in determining this alternative's harvest unit design, location and silvicultural treatments:

- Minimize harvesting in high quality, sensitive species habitat.
- Maintain wildlife corridors for north-south movement, and along riparian areas.
- Minimize harvesting in the largest blocks of old stands.
- Maintain old stands with the highest values for old growth associated species.
- Target, as highest priority for harvesting, stands that have poor tree quality, poor vigor and/or exhibit major insect and disease problems.
- Consider, as a lower priority for harvesting, other stands that have higher tree quality vigor and/or may not exhibit insect and disease problems.

Specific treatment objectives for each cutting unit in the alternatives are discussed in Chapter 2 of the draft EIS.

ALTERNATIVE C

Alternative C (Figure 2.3) would harvest approximately 10 MMBF from 668 acres. A total 1.9 miles of new road would be constructed to provide access to units 2, 3, 6, 8 and 10.
This alternative incorporates specific criteria developed to address public comments that the proposed project should maintain existing old growth. These criteria were used in determining this alternative's harvest unit design, location and silvicultural treatments:

- No harvesting of stands identified in the SLI as old growth.
- Target, as highest priority for harvesting, non old growth stands that have poor tree quality, poor vigor and/or exhibit major insect and disease problems.
- Consider, as a lower priority for harvesting, other non old growth stands that have higher tree quality vigor and/or may not exhibit insect and disease problems.

- Maintain an existing low elevation east-west wildlife travel corridor along the South Fork of Lost Creek.
- Maintain north-south wildlife travel corridors between lower and higher elevations within the project area.
- Maintain an existing low elevation north-south wildlife travel corridor on the west side of the project area.

Specific treatment objectives for each cutting unit in the alternatives are discussed in Chapter 2 of the draft EIS.

ALTERNATIVE D

Alternative D (Figure 2.4) would harvest approximately 10 MMBF from 695 acres. It would require 1.7 miles of new road to provide access to units 3, 4, and 5.

This alternative was developed to address public comments that the proposed project should promote timber productivity. The following criteria were used in determining harvest unit design, location and silvicultural treatments:

- Harvest only within stands that have the highest risk of value loss through mortality, poor to very poor vigor, poor tree quality and/or exhibit major insect and disease problems.
- Apply silvicultural treatments that would contribute to optimizing future timber productivity within stands treated.
- Harvest priorities and silvicultural treatments would be modified to maintain important wildlife travel corridors and contiguous blocks of old stands and old growth, to the extent timber productivity would not be overly compromised.

Specific treatment objectives for each cutting unit in the alternatives are discussed in Chapter 2 of the draft EIS.

Permits Required to Implement the Project

1. A Stream Preservation Act Permit (124 permit) is required from DFWP for activities that could affect any fisheries stream.

2. A short-term exemption from Montana's Surface Water Quality Standards (3A Authorization) is needed whenever temporary activities introduce sediment above natural levels into live streams. This permit from the Montana Department of Environmental Quality (DEQ) would be needed for two bridge removals, replacement of a bridge on Cliff Creek, and some culvert installations.

SUMMARY OF ENVIRONMENTAL EFFECTS

The following table summarizes the environmental consequences of the alternatives. The scientific basis for the environmental effects summarized here is discussed in more detail in Chapter 4 of the draft EIS.

TABLE 2.1 SUMMARY OF ENVIRONMENTAL EFFECTS

RESOURCE	ALTERNATIVES			
	A	B	C	D
Forest Conditions				
1. Cover Type Representation	Continued shift to shade-tolerant species	Increase shade-intolerant species by 222 acres*	Increase shade-intolerant species by 405 acres	Increase shade-intolerant species by 411 acres
2. Age Class Distribution and Old Stands in Project Area	Overall increase in old stands over time	Old stands reduced by 76 acres	Old stands reduced by 74 acres	Old stands reduced by 135 acres
3. Replacement Old Stands in Western larch / Douglas-fir type	No development of replacement old stands	No development of replacement old stands	Increase of 8 %	Increase of 7%
4. Stand Vigor	Shade-intolerant species crowed out; reduction in vigor	468 acres raised to full vigor; 209 acres raised one vigor class*	577 acres raised to full vigor	302 acres raised to full vigor; 355 acres raised one vigor class; no change in 48 acres
5. Patch Sizes by Cover Type	Increased patch size over time	Decrease in patch sizes in white pine, subalpine fir and mixed conifer types; increase in patch size in western larch/ Douglas-fir and Douglas-fir types	Decrease in patch size in white pine, Douglas-fir, subalpine fire and mixed conifer types; increase in patch sizes on western larch/Douglas-fir types	Decrease in patch size on white pine, western larch/Douglas-fir, subalpine fir and mixed conifer types.
6. Patch Sizes by Age Class in the project area	Increase in patch size by age class over time	41-acre decrease in average patch size in old stands	109-acre decrease in average patch size in old stands	47-acre decrease in average patch size in old stands
7. Patch Shape by Cover Type	Reduction in complexity of patch shape**	Reduction in complexity of patch shape	Reduction in complexity of patch shape	Reduction in complexity of patch shape
8. Patch Shape by Age Class	Decrease in patch shape	Increase in complexity of old stand patches	No effects on patch shape	Substantial Decrease in patch shape complexity
Grizzly Bear				
1. Open Roads (% entire subunit >1.0 mi/mi ^{2})	28%	28%	28%	28%

TABLE 2.1 SUMMARY OF ENVIRONMENTAL EFFECTS

RESOURCE	ALTERNATIVES			
	A	B	C	D
2. Open Roads (% DNRC acres >1.0 mi/mi^2)	34%	34%	34%	34%
3. Total Roads (% entire subunit >2.0 mi/mi ^{2})	45%	47%	47%	47%
4. Total Roads (% DNRC acres >2.0 mi/mi ^{2})	54%	56%	56%	55%
5. Core Area (entire subunit)	45%	36%	36%	37%
6. Core Area (DNRC acres)	28%	25%	24%	27%
7. Hiding Cover (entire subunit)	79%	77%	47%	78%
8. Hiding Cover (DNRC acres)	91%	25%	89%	89%
Elk				
1. Habitat Effectiveness	71%	54%	51%	53%
2. Thermal Cover (% of winter range, *(remaining after harvest?)* DNRC acres)	23%	19%	23%	19%
3. Elk Security Cover (DNRC acres)	45%	10%	10%	10

TABLE 2.1 SUMMARY OF ENVIRONMENTAL EFFECTS

RESOURCE	ALTERNATIVES			
	A	B	C	D
Aesthetics* **				
1. General landscape characteristics (Variety = landscapes which are object-rich; contrast = the degree to which objects are distinguished from one another; texture = distinctive or identifying feature of the landscape depending on distance)	Change would continue due to natural processes. Character of landscape would remain the same.	Wild, rugged character would remain the same. Light and moderate-reserve treatments would increase variety and contrast. Heavy-reserve treatment would change texture, with subtle changes to variety and contrast.	Wild, rugged character would remain the same. Light and moderate-reserve treatments would increase variety and contrast. Heavy-reserve treatment would change texture, with subtle changes to variety and contrast.	Wild, rugged character would remain the same. Light and moderate-reserve treatments would increase variety and contrast. Heavy-reserve treatment would change texture with subtle changes to variety. Structural enhancement treatment would result in subtle changes to texture
Water Quality				
1. Annual runoff South Fork Lost Creek Watershed	1% increase over natural runoff. (10% allowable increase)	3% increase over natural runoff. (10% allowable increase)	3% increase over natural runoff. (10% allowable increase)	2% increase over natural runoff. (10 % allowable increase)
2. Number of cutting units located within a SMZ.	None	None	None	None
3. Existing Sources of Sediment that would be mitigated.	Erosion sources not mitigated.	10.3 miles of road brought up to current BMPs, relocation of 1.7 miles of road currently located in SMZ, replacement of Cliff Creek bridge, rehabilitation of 2 bridges on S. Fork Lost Creek.	10.3 miles of road brought up to current BMPs, relocation of 1.7 miles of road currently located in SMZ, replacement of Cliff Creek bridge, rehabilitation of 2 bridges on S. Fork Lost Creek.	10.3 miles of road brought up to current BMPs, relocation of 1.7 miles of road currently located in SMZ, replacement of Cliff Creek bridge, rehabilitation of 2 bridges on S. Fork Lost Creek.

TABLE 2.1 SUMMARY OF ENVIRONMENTAL EFFECTS

RESOURCE	ALTERNATIVES			
	A	B	C	D
Fisheries				
1. Impacts to fisheries habitat	No change to fisheries from current condition. No additional habitat monitoring.	Low potential risk to fisheries habitat or populations. Continue to monitor fish habitat for at least one year after project completion.	Low potential risk to fisheries habitat or populations. Continue to monitor fish habitat for at least one year after project completion.	Low potential risk to fisheries habitat or populations. Continue to monitor fish habitat for at least one year after project completion.
Air Quality				
	No change to existing air quality.	Burning on 626 acres: Temporary reduction in air quality.	Burning on 668 acres: Temporary reduction in air quality.	Burning on 695 acres: Temporary reduction in air quality.
Soils				
1. Soil Erosion Potential from Road System	Erosion potential may increase on existing road system.	Decrease erosion potential by implementing mitigation.	Decrease erosion potential by implementing mitigation.	Decrease erosion potential by implementing mitigation.
2. Soil Impacts: Displacement and Compaction	No change in existing compaction of the area in old skid trails and landings.	Mitigation would limit impacts to about 8% of the harvested acres. Approximately 48 acres would be affected	Mitigation would limit impacts to about 6% of the harvested acres. Approximately 39 acres would be affected	Mitigation would limit impacts to about 11% of the harvested acres. Approximately 72 acres would be affected
Sensitive Species				
1. Black-backed Woodpeckers	Probability of creation of habitat would remain stable or increase with time, and acreage of potential future habitat would not change	Reduction in probability of creation of habitat, and reduction in acreage of potential future habitat by 508 acres	Reduction in probability of creation of habitat, and reduction in acreage of potential future habitat by 458 acres	Reduction in probability of creation of habitat, and reduction in acreage of potential future habitat by 305 acres

RESOURCE	ALTERNATIVES			
	A	B	C	D
2. Western Big-eared Bat	No change in communal or individual roost site availability	No change in communal roost site availability. Some decrease in availability of individual roost sites	No change in communal roost site availability. Some decrease in availability of individual roost sites	No change in communal roost site availability. Some decrease in availability of individual roost sites
3. Boreal Owls	No harvest would be done in the 247 acres of boreal owl habitat in the project area	46 acres (19%) of the boreal owl habitat in the project area would be harvested	No harvest would be done in the 247 acres of boreal owl habitat in the project area	113 acres (46%) of the boreal owl habitat in the project area would be harvested
4. Fisher	No harvest would be done in preferred fisher riparian habitat. Trapper access into preferred habitat would remain high. Travel cover would remain available over most of the project area.	No harvest would take place in preferred riparian habitat. Trapper access into preferred habitat would decrease. Travel cover would be reduced for next 20-40 years on 54 acres.	No harvest would take place in preferred riparian habitat. Trapper access into preferred habitat would decrease. Travel cover would be reduced for next 20-40 years on 11 acres.	No harvest would take place in preferred riparian habitat. Trapper access into preferred habitat would decrease. Travel cover would be reduced for next 20-40 years on 11 acres and for next 15-20 years on 260 acres.

RESOURCE	ALTERNATIVES			
	A	B	C	D
5. Lynx	No changes in availability of foraging habitat, trapper access, or travel cover. Availability of denning habitat probably would remain stable, and quality might increase over time.	Foraging habitat availability probably would increase on 339 acres. Cover for travel would decrease for 10-20 years on these same 339 acres. Trapper access probably would not change. 46 acres of potential denning habitat would be harvested.	Foraging habitat availability probably would increase on 191 acres. Cover for travel would decrease for 10-20 years on these same 191 acres. Trapper access probably would not change. Availability of denning habitat should remain stable, and quality might increase over time.	Foraging habitat availability probably would increase on 241 acres. Cover for travel would decrease for 10-20 years on these same 241 acres. Trapper access probably would not change. 113 acres of potential denning habitat would be harvested.
6. Pileated Woodpeckers	No harvest would take place in nesting or foraging habitat.	No harvest would take place in nesting habitat. Quality of foraging habitat would greatly decrease on 79 acres.	No harvest would take place in nesting habitat. Quality of foraging habitat would greatly decrease on 11 acres.	Structural enhancement harvest in nesting habitat may improve habitat in the long run if skid trails do not increase access for firewood cutters. Quality of foraging habitat would decrease somewhat on 260 acres.

*Indications of increased acreage refer to conditions after harvest and regeneration, either natural or by planting, or both.

**Numbers indicating patch shape refer to an index developed by McGarigal and Marks (1994). The lowest number, 1, refers to a perfectly square patch.

***As noted in the text, harvest units generally will be out of view of the public, or visible only at a distance.

Draft Environmental Impact Statement

This draft environmental impact statement was prepared in compliance with the Montana Environmental Policy Act (MEPA). MEPA requires state government to include consideration of environmental impacts into its decision-making process. It also requires agencies to inform the public and other interested parties about proposed projects, environmental impacts that might result, and alternative actions that could achieve project objectives.

DNRC solicited public participation in the South Fork Lost Creek project on December 2, 1994, by distributing a project proposal to interested individuals, landowners, organizations, industries, and agencies. The proposed project also was advertised in the area's newspapers.

The mailing list for parties interested in the project is located in Appendix A of the draft EIS.

DNRC evaluated the public comments and used many of them to develop alternative methods of achieving the proposed project. These alternatives, along with the no-action alternative and other information pertaining to the proposed project, are incorporated into this draft EIS, which is circulated to all those known to be interested. Comments on the draft EIS will be accepted for 30 days.

Final EIS

After all the public comments on the draft EIS are received and evaluated, DNRC will prepare a final EIS, which will consist primarily of a revision of the draft EIS to incorporate new information based on public and internal comments. It also will include DNRC's preferred alternative.

Notice of Decision

Following publication of the final EIS, the Unit Manager of Swan River State Forest will review all of the information contained in the EIS and project file, including public comments. No sooner than 15 days after the publication of the final EIS, the Unit Manager will consider and determine the following:

1. Do the alternatives presented in the final EIS meet the project purpose?
2. Is the proposed mitigation adequate and feasible?
3. Which alternative should be implemented and why?

These determinations will be published in a decision notice and distributed to all interested parties.

Proposed Schedule of Activities

After the notice of decision is published, a contract package would be prepared if a timber harvest alternative is selected. The package would then be sent to the Land Board for approval. After approval by the Land Board the timber would be advertised for sale.

If the timber is sold, then the following schedule would apply.

SRSF would sell timber from the proposed project in July 1998. Timber harvesting and road construction/improvement work would begin in the fall of 1998 and be completed by April, 2000. Planting and hazard reduction work would be completed within 2 years following completion of harvesting. Some activities would be restricted to certain periods of the year to avoid or reduce impacts (mitigation information is included in Chapter 4 of the draft EIS).

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ABBREVIATIONS

BMP	Best Management Practices
BMU	Bear Management Unit
CEA	cumulative effects assessment
DBH	diameter at breast height
DEQ	Montana Department of Environmental Quality
DFWP	Montana Department of Fish, Wildlife and Parks
DNRC	Montana Department of Natural Resources and Conservation
ECA	Equivalent Clearcut Acres
EIS	environmental impact statement
ESA	Endangered Species Act
FI	Forest Improvement
FNF	Flathead National Forest
FRTA	National Forest Roads and Trails Act
FY	fiscal year
GIS	Geographic Information System
H.E.	habitat effectiveness
HTG	habitat type groups
ICRB	Interior Columbia River Basin Project
ID Team	interdisciplinary team
MBF	thousand board feet
MEPA	Montana Environmental Policy Act
MFI	mean fire interval
MMBF	million board feet
NCDE	Northern Continental Divide Ecosystem (Grizzly Bear Recovery Area)
ORD	open road density
OSHA	Office of Safety and Health Administration
RMS	Resource Management Standard
ROD	Record of Decision
SFLMP	State Forest Land Management Plan
SLI	Stand Level Inventory
SMZ	streamside management zone
SRSF	Swan River State Forest
SSFI	sale specific forest improvement
SVGBCA	Swan Valley Grizzly Bear Conservation Agreement
TAS	timber accounting system
TRD	total road density
USFS	United States Forest Service
USFWS	United States Fish and Wildlife Service

GLOSSARY

Acre-foot
A measure of water or sediment volume, equal to an amount of material that would cover one acre to a depth of one foot.

Aesthetic
Pertaining to beauty.

Airshed
An area defined by a certain set of air conditions; typically a mountain valley in which air movement is constrained by natural conditions such as topography.

B-4 Channel Type
The South Fork of Lost Creek is classified as a B-4 channel type according to the stream classification system developed by David Rosgen (1994). B-4 channel types include channel gradients of 2-4 percent, width to depth ratio greater than 12, and channel materials composed mainly of coarse gravel. B-4 channels are considered moderately stable, and have a very high recovery potential. This means that bed and banks are moderately prone to becoming unstable given a disturbance (e.g. water yield increases, physical disturbance), but that they also reach a stable equilibrium rapidly or respond well to rehabilitation. They tend to have low natural rates of bank erosion, but do carry high levels of bedload (larger creek bed material which is not suspended in the water, but rolls downstream along the channel bottom).

Basal Area
A measure of the number of square feet of space occupied by the stem of a tree.

Best Management Practices
A practice or combination of practices that is determined by a state or designated area-wide planning agency to be the most effective, practicable (including technological, economic, and institutional considerations) means of preventing or reducing the amount of pollution generated by nonpoint sources to a level compatible with water quality goals.

Biodiversity
The variety of life, and its processes. It includes the variety of living organisms, the genetic differences among them, and the communities and ecosystems in which they occur.

Board Foot
144 cubic inches of wood, equivalent to piece of lumber 1-inch thick by 1-foot wide by 1-foot long.

Boreal Forest
The type of forest found in the Northern Temperate Zones and Arctic region.

Canopy
The more-or-less continuous cover of branches and foliage formed collectively by the crown of adjacent trees and other woody growth.

Cavity
A hollow excavated in trees by birds or other animals. Cavities are used for roosting and reproduction by many birds and mammals.

Characteristic Landscape
The overall impression of a landscape created by its unique combination of visual features (such as land, vegetation, water, and structures) as seen in terms of form, line, color, and texture.

Compaction
Increase in soil density caused by force exerted at the soil surface.

Connectivity
The quality, extent, or state of being joined; unity; the opposite of fragmentation.

Contrast
A term used in visual assessments to indicated the degree to which objects are distinguishable from one another.

Core Area
See Security Habitat (grizzly bears)

Corridor
- *Mature forest corridor* - A contiguous area of mature forest at least 100 meters wide, having at least 40 percent canopy cover, and connecting two or more larger areas of mature forest.
- *Movement corridor* - A narrow but continuous area of habitat connecting larger areas of habitat that animals use for travel. Often referred to as "dispersal " or "wildlife" corridor.

Cover
See **HIDING COVER** and/or **THERMAL COVER**.

Crown Classes:
- *Codominant Crown Class*--Trees with crowns forming the general level of the crown cover and receiving full light from above but comparatively little from the side; usually with medium-sized crowns more or less crowded on the sides.

- *Dominant Crown Class*--Trees larger than the average in stands, with well-developed crowns extending above the general level of the crown cover and receiving full light from above and partly from the side, possibly somewhat crowded on the sides.

- *Intermediate Crown Class*--Trees with crowns extending into the crown cover formed by codominant and dominant trees; receiving a little direct light from above but none from the sides; usually with small crowns considerably crowded on the sides.

Cutting Units
Areas of timber proposed for harvest.

DBH (diameter at breast height) Class
A group of trees within a given diameter range, e.g., 5 to 10 inches

Discounting
In economics, a method of accounting for the value of money over time, its ability to earn interest, so that costs and benefits occurring at different points in time are brought to a common date for comparison.

Ditch Relief
A method of draining water from roads using ditches and a corrugated metal pipe. The pipe is placed just under the road surface.

Dominance Elements (in a landscape)
Landscapes are dominated by the primary elements of color, texture, form, and line. When changes occur within that landscape, changes also may occur to these elements. The elements are:

- *Color* - Color (or degree of a certain color) on the landscape.
- *Texture* - The surface characteristics, or coarseness, of objects within the landscape or overall patterns of surface characteristics on the landscape.
- *Form* - The overall shape and structure of an object such as a tree or mountain.
- *Line* - The direction of a major pattern within the landscape such as tree trunks in a forest.

Drainage Area
See WATERSHED.

Ecosystem
An interacting system of living organisms and the land and water that make up their environment; the home place of all living things, including humans.

Environmental Effects
The impacts or effects of a project on the natural and human environment.

Equivalent Clearcut Area (ECA)
The total area within a watershed where timber has been completely removed, including clearcuts, partial cuts, roads, and burns.

- *Allowable ECA* - The estimated number of acres that can be clearcut before stream channel stability is affected.
- *Existing ECA* - The number of acres that have been previously harvested taking into account the degree of hydrologic recovery that has occurred due to revegetation.
- *Remaining ECA* -The calculated amount of harvest that may occur without substantially increasing the risk of causing detrimental effects to stream channel stability.

Excavator Piling
Piling of logging residue using an excavator.

Fall-transition Range
Forage areas used by deer as they move from the higher elevations they occupy in the summer to the lower elevations they occupy in the winter.

Flush
A brief abundance (as in the flush of insects after a wildfire).

Forage
All browse and non-woody plants available to wildlife for grazing.

Forest Improvement
The establishment and growing of trees after a site has been harvested. Associated activities include site preparation, planting, survival checks, regeneration surveys, and thinning of the stand.

Forest Products
Products derived from trees, such as lumber, poles, and fuel chips.

Fragmentation (forest)
A reduction of connectivity and increase in sharp stand edges resulting when large contiguous areas of forest with similar age and structural character are interrupted through disturbance (e.g., stand replacement fire, timber harvesting).

Grass/Shrub/Seedling Size Class
A ground cover predominantly of grass, shrub or seedlings (live trees less than 1.0 inch dbh)

Habitat
The place where a plant or animal naturally or normally lives and grows.

Habitat Effectiveness
The percentage of available habitat that is useable by elk during the nonhunting season (in comparison to potential elk use).

Habitat Type

Hand-burning
The process of manually igniting piles of logging residue.

Hazard Reduction
The abatement of a fire hazard by processing logging residue with methods such as separation, removal, scattering, lopping, crushing, piling and burning, broadcast burning, burying, and chipping.

Hectare
Ten thousand square meters or 2.47 acres.

Hiding Cover
- *Elk & White-tailed deer* - Vegetation capable of hiding 90 percent of a standing elk from view of a human at 200 feet during the period when elk normally use the area.
- *Grizzly Bear* - A patch of vegetation having a minimum width of at least three sight distances (distance at which 90 percent of a bear is hidden from view) or 300 feet--whichever is greater.

Historical Forest Condition
The condition of the forest prior to settlement by Europeans.

Interdisciplinary Team
A team of resource specialists brought together to analyze the effects of a project on the environment.

Irretrievable Commitment of Resources
Resources that are lost for a period of time, such as harvested timber or other renewable natural resources. A stand of trees that is cut has been irretrievably lost (as opposed to irreversibly lost) because the stand can regenerate.

Irreversible Commitment of Resources
Loss of resources that cannot be reversed except perhaps in the extreme long term, such as minerals, historical or archaeological resources; or vegetation and habitat lost to permanent roads. Irreversible also refers to the loss of future options.

Linkage Zones
Areas delineated in Attachment E of the SVGBCA for the purpose of enhancing grizzly bear habitat connectivity between the Swan and Mission mountains.

Logging Residue
Unmerchantable logs, uprooted stumps, broken or uprooted stems, branches, twigs, leaves, bark, and chips left on the ground after timber harvesting, storms, fire, or other disturbance.

Lop and Scatter
Bucking up and scattering logging residue to reduce fire hazard.

Low-elevation Linkage Zones
Lower elevation portions of Linkage Zones delineated in Attachment H of the SVGBCA.

Mass Failure
A downhill movement of soil or fractured rock under the force of gravity, e.g., a landslide..

Mature Forest Types
Forested stands categorized as old growth or saw-timber.

McNeil Coring
A method of measuring a sample of stream bed material to determine the percentage of fine material. The higher the percentage of fine material within the stream bed the lower the quality of spawning habitat for trout.

Merchantable
Describes trees that can be profitably converted into a salable product such as lumber.

Mitigation Measure
Measure designed to reduce or prevent detrimental effects.

Moving Window
A computer-based method which, in this EIS, is used to quantify the area influenced by roads in a study area. Starting with the pixel in the upper left corner of the computerized subunit map, the computer calculates how many miles of road exist within a 1 square mile "window" around that pixel. It moves to the next pixel and repeats the process until the road density is calculated in a 1 square mile area around every pixel in the study area. The number and percentage of pixels in the study area that fall into different road density classes are then calculated by the computer. Based on research studying the effects of roads on grizzly bears, the effects of open roads are measured by the percentage of the pixels in the study area which have at least 1.0 miles of open road in the surrounding 1 square mile window. The effects of total roads (open, gated, barricaded, bermed but not brushed, etc.) are measured by the percentage of pixels in the study area which have at least 2 miles of open or restricted roads in the surrounding 1 square mile window.

Multi-story Stands
Timber stands with two or more distinct stories.

No-action Alternative
The option of maintaining the status quo and continuing present management activities and/or not implementing the proposed project.

Non-forested Area
A naturally occurring area where trees do not establish over the long-term such as a bog or avalanche chute.

Old Growth
- Old growth represents the later stages of natural development of forest stands. Old-growth stands are generally understood to be dominated by relatively large old trees, containing wide variation in tree sizes, exhibiting some degree of multi storied structure, having signs of decadence such as rot and spike-topped structure, and containing standing large snags and large down logs.
- The SRSF Stand Level Inventory identifies stands as old growth if they have a saw-timber stand class code, if the crown density of saw-timber trees in the stand is greater than 39 percent, if they contribute to a contiguous area of old growth at least 50 acres in size, and if they meet at least one of the following criteria:
  - The average age of trees in the stand is at least 200 years.
  - The stand contains trees at least 150 years old, and the stand structure is multi-storied or heterogeneous.
  - The stand contains trees that average at least 100 years old and up to 140 years old, with a multi- storied or heterogeneous stand structure and fair-to-poor or very poor vigor.

Older Pole
Pole-timber stands more than 40 years old.

Overstory
SRSF Stand Level Inventory code applies this term to any stand that contains commercial-size trees in excess of 1,000 board feet per acre, and which also meets one of the following conditions (1) The trees in question are relics (i.e. not part of the manageable stand components); (2) The trees in question represent the upper story of a two-story stand, but they are inadequately stocked to be treated as a separate management component.

Patch
A discrete area of forest connected to other discrete forest areas by relatively narrow corridors; an ecosystem element (such as vegetation) that is relatively homogeneous internally but differs from what surrounds it.

Patch Shape Index
A system for assessing patch shape, or a number indicating this shape. The system used in this EIS was developed by McGarigal and Marks (1994). Under this system, a perfectly square patch is represented by the number 1. Circular patches are indicated with numbers less than one. The higher the number, the more complex the shape.

Pole Timber
- *Pole-timber stands* - Stands at least 16.7 percent stocked with growing stock trees of which 50 percent or more are in pole timber and/or saw-timber trees, and with pole-timber stocking exceeding that of saw timber.
- *Pole-timber trees* - Trees at least 5.0 inches dbh but smaller than 9.0 inches for softwoods and 11.0 inches for hardwoods.

Post-old Growth
Old-growth stands where the seral overstory begins dying, overhead canopy declines, and the climax dominants begin to take over the stand. This occurs as a result of natural forest succession in stands without major disturbance over a long period of time. Although the stands maintain some of the characteristics of old growth (e.g., abundance of snags and down-woody material) they lack others (high canopy coverage of large-diameter overstory dominants, large snags composed of seral species).

Preferred Habitats
Areas adjacent to streams and wetlands inside Linkage Zones as set forth in Attachment G of the SVGBCA.

Project File
A public record of the analysis process, including all documents that form the basis for the project analysis. The project file for the South Lost Creek EIS is located at the Swan River State Forest office near Swan Lake, Montana.

Reach
A portion of a body of flowing water.

Redds
The spawning nests of trout.

Regeneration
Trees in the seedling and sapling stage of growth; or the act of establishing young trees naturally or artificially.

Regeneration Harvest
A type of harvest conducted with the twin purposes of removing old trees and creating environments favorable for establishment of new trees.

Risk
- *High risk* - An SRSF Stand Level Inventory code which pertains to the following: (1) All commercial, nonvigorous, overmature stands, and any merchantable stand that exhibits an unmanageable insect or disease problem; or (2) Lodgepole saw-timber stands over 100 years old.
- *Low risk* - An SRSF Stand Level Inventory code that pertains to the following types of stands (1) All commercial stands older than 100 years that do not qualify as high risk (They have relatively better vigor than high-risk stands); (2) All commercial stands that do not qualify as high risk and are dominated by shade-tolerant species (regardless of age); (3) All commercial lodgepole stands 50-100 years old and nonvigorous, and which have not qualified as high risk; (4) Various other stands containing commercial material which are not manageable because of poor tree quality and vigor.

Road Improvements
Construction projects on an existing road to improve ease of travel, safety, drainage, and water quality.

Roads
The following kinds of roads were considered in road density estimates for grizzly bear habitat.

- *Administrative roads* - Administrative roads provide access to administrative structures or to noncorporate private property. Administrative roads are excluded from calculations of open road density and total road density.
- *Open roads* - Open roads pertaining to the grizzly bear analysis are roads without use restrictions. They are seasonally opened to the public during the non-denning period (3/16 - 11/15). They are administered by DNRC, Plum Creek, or the U.S. Forest Service (USFS).
- *Private roads* - Roads on nonindustrial private lands. Private roads are excluded from open and total road density estimates.
- *Reclaimed roads* - Reclaimed roads are generally impassable to motorized vehicles for most of their length. Drainage features on the road are not maintained because future use of the roads is not intended. Reclaimed roads are not included in linear mileage or road density calculations.
- *Restricted roads* - A road administered by DNRC, USFS, or Plum Creek on which motorized use is restricted during the entire nondenning period (3/16-11/15) by a physical obstruction. Restricted roads are included in calculations of total road density.

Roll Dip
A graded depression built into a road to divert water and prevent soil erosion.

Rotation Schedule
The schedule (in years) set forth in Attachment I of the SVGBCA, by which the parties to the SVGBCA concentrate Administrative and Commercial Use within grizzly bear management subunits in the Swan Valley Conservation Area.

Saplings
Trees 1.0 inches to 4.0 inches in diameter at breast height.

Saw-timber Trees
Softwood trees 9.0 inches and larger dbh.

Scarification
The mechanized gouging and ripping of surface vegetation and litter to expose mineral soil and enhance the establishment of natural regeneration.

Scope
The range of reasonable alternatives, mitigation, issues, and potential impacts to be considered in an environmental assessment or environmental impact statement.

Scoping
The process of determining the extent of the environmental assessment task. Scoping includes public involvement to learn which issues and concerns should be addressed, and the depth of assessment that will be required. It also includes a review of other factors such as laws, policies, actions by other landowners, and jurisdictions of other agencies that may affect the extent of assessment needed.

Security
For wild animals the freedom from the likelihood of displacement or mortality due to human disturbance or confrontation.

Security Area (elk)
An area of at least 250 contiguous acres that is more than 0.5 miles from all roads with use levels of more than one vehicle per week.

Security Habitat (grizzly bears)
An area of at least 2,500 acres that is at least 0.3 miles from trails or roads with motorized travel and high-intensity, nonmotorized use during the nondenning period.

Seedlings
Live trees less than 1.0 inch dbh.

Sediment
In bodies of water, solid material, mineral or organic, that is suspended and transported or deposited.

Sediment Yield
The amount of sediment that is carried to streams.

Sequoia Index
A number indicating increased sedimentation caused by forest management activities, and the method used in determining this.

Seral
Refers to a biotic community that is in a developmental, transitional stage in ecological succession.

Shade-intolerant
Describes tree species that generally can only reproduce and grow in the open or where the overstory is broken and allows sufficient sunlight to penetrate. Often these are seral species that get replaced by more shade-tolerant species during succession. In the Swan valley, shade-intolerant species generally include ponderosa pine, western larch, Douglas-fir, white pine, and lodgepole pine.

Shade-tolerant
Describes tree species that can reproduce and grow under the canopy in poor sunlight conditions. These species replace less shade-tolerant species during succession. In the Swan valley, shade-tolerant species generally include subalpine fir, grand fir, Douglas-fir, Engelmann spruce, and western red cedar.

Sight Distance
In the case of grizzly bears, refers to the distance at which 90 percent of a bear is hidden from view.

Silviculture
The art and science of controlling the establishment, composition, and growth of forests, to accomplish specific objectives.

Site Preparation
A hand or mechanized manipulation of a harvested site to enhance the success of regeneration. Treatments are intended to modify the soil, litter, and vegetation and to create microclimate conditions conducive to the establishment and growth of desired species.

Snag
A standing dead tree.

Snow Intercept
The action of trees and other plants in catching falling snow and preventing it from reaching the ground.

Spur Roads
Temporary roads, closed after harvest, constructed to meet minimum requirements for harvest-related traffic.

Stand
An aggregation of trees occupying a specific area and sufficiently uniform in composition, age arrangement, and condition as to be distinguishable from the adjoining forest.

Stand Density
Number of trees per acre.

Stocking
The degree of occupancy of land by trees as measured by basal area or number of trees and as compared to a stocking standard, which is an estimate of either the basal area or number of trees per acre required to fully use the growth potential of the land.

Stream Gradient
The slope of a stream along its course, usually expressed in percentage indicating the amount of drop per 100 feet.

Stumpage
The value of standing timber; the market value of manufactured forest products or sawlogs minus their production costs.

Subnivean Spaces
Air pockets or open areas beneath the surface of the snow.

Succession
In plant communities, the process of progressive changes with growth.

Swan Valley Conservation Area
Geographic area encompassed by the Swan Valley Grizzly Bear Conservation Agreement

Texture
A term used in visual assessments indicating distinctive or identifying features of the landscape depending on distance.

Thermal Cover (elk)
A stand of conifers at least 40 feet tall with an average canopy closure exceeding 70 percent.

Timber Harvesting Activities
In general, "timber harvesting activities" refers to all the activities conducted to facilitate timber removal before, during, and after the timber is removed. These activities may include any or all of the following:

felling standing trees and bucking into logs
skidding logs to a landing
processing, sorting, and loading logs at the landing
hauling logs to a mill
road construction
right-of-way clearing
excavation of cut/fill material
installation of road surface and ditch drainage features
installation of culverts at stream crossings
burning right-of-way slash
hauling and installation of borrow material
blading and shaping road surfaces
slashing and sanitizing residual vegetation damaged during logging
machine piling logging slash
burning logging slash
scarification
planting trees

Total Road Density
See **ROADS**

Understory
The trees and other woody species growing under a more-or-less continuous cover of branches and foliage formed collectively by the overstory of adjacent trees and other woody growth.

Variety
A term used in visual assessments indicating landscapes which are object-rich.

Vigor
The degree of health and growth of a tree or stand.

Vigor Class
The following vigor classes are based on the SRSF Stand Level Inventory.

- *full vigor* - The full vigor class is represented by open-grown trees. Crown closure has not occurred, and growth is optimal.
- *good-to-fair vigor* - Crowns are closed at least in clumps; crown lengths are greater than 50 percent in young stands and greater than 33 percent in older stands. Growth has not yet slowed greatly.
- *fair-to-poor vigor* - Crown ratios are poor. Growth and mortality are nearly balanced.
- *very poor vigor* - Stands having very poor vigor are generally in a decadent condition due to insects, disease, stagnation, suppression or old age. Mortality is likely to exceed growth.

Visual Screening
Vegetative cover which, at the minimum, hides 90 percent of a grizzly bear.

WATSED
A computer model that uses existing condition data to predict increases in water yield over natural conditions and related increases in sediment entering streams.

Watershed
The region or area drained by a river or other body of water.

Water Yield
The average annual runoff for a particular watershed expressed in acre-feet.

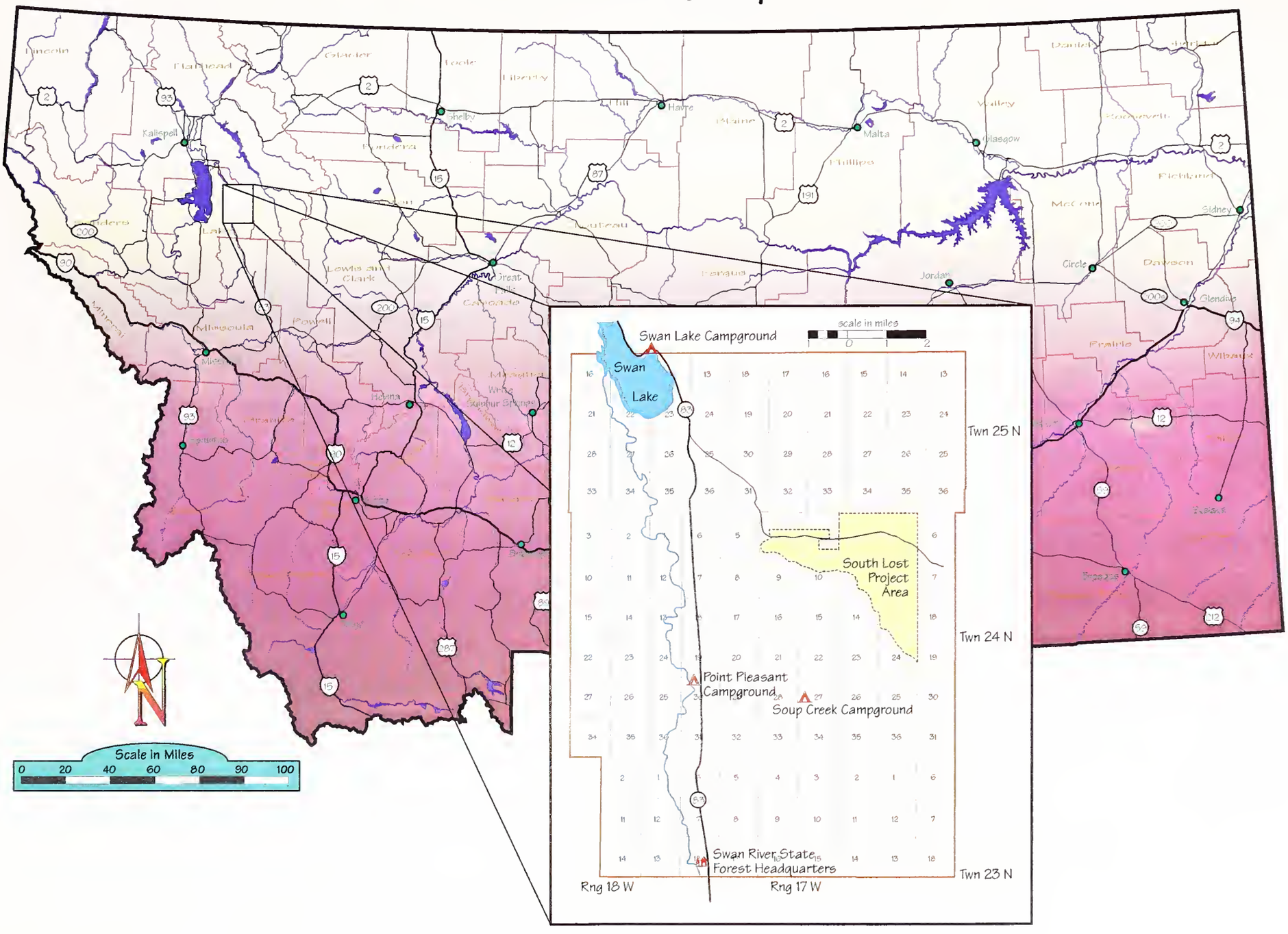
Water Yield Increase
An increase in average annual runoff over natural conditions due to forest canopy removal.

Weibull Function
An equation useful for determining age class distributions. The equation is: $P=1-\exp(-age/a)^b$ where P=proportion of acres in an age class; a=fire return interval in years; and ^{b}=shape parameter (Johnson and VanWagner 1985).

Yield Capability
The maximum mean annual increment of wood that can be grown in a fully stocked natural stand expressed in cubic feet per acre per year.

Young Pole
Pole-timber stands that are less than 30 years old.

Figure 1.1
South Fork Lost Creek
General Vicinity Map



CHAPTER 1

INTRODUCTION

Swan River State Forest (SRSF) proposes to harvest timber in the South Fork of Lost Creek drainage to generate revenue for the Montana School Trust (Figure 1.1). SRSF is a branch of the Montana Department of Natural Resources (DNRC). The project area is located approximately 4 miles southeast of Swan Lake, Montana, and includes three full sections and portions of eight others in T24N-R17W, for a total of approximately 4,306 acres. If a harvest alternative is selected, 626 to 695 acres would be harvested with various silvicultural treatments.

I. PURPOSE

In December of 1994, DNRC proposed to harvest 10 MMBF of timber in order to generate revenue through sustainable timber harvesting. The volume target is part of the SRSF's annual harvest objective. The SRSF Stand Level Inventory was screened to identify stands classified at risk and recommended for harvest.

In 1996, DNRC adopted the State Forest Land Management Plan (SFLMP 1996). On May 30, 1996, DNRC released the Record of Decision on the SFLMP. The State Board of Land Commissioners approved implementation of the SFLMP on June 17, 1996. The SFLMP outlines DNRC's management philosophy for State forested trust lands, and sets out specific Resource Management Standards for 10 resource categories. The SFLMP states:

> Our premise is that the best way to produce long-term income for the trust is to manage intensively for healthy and biologically diverse forests. Our understanding is that a diverse forest is a stable forest that will produce the most reliable and highest long-term revenue stream.... In the foreseeable future, timber management will continue to be our primary source of revenue and our primary tool for achieving biodiversity objectives .

The land involved in this proposed project is held by the State of Montana in trust for the support of public schools (Enabling Act of February 22, 1889; 1972 Montana Constitution, Article X, Section 11). DNRC and the State Board of Land Commissioners (Land Board) are required by law to administer these trust lands to produce the largest reasonable and legitimate return over the long run (Section 77-1-202, MCA).

II. RELATIONSHIP TO THE STATE FOREST LAND MANAGEMENT PLAN

The SFLMP is a programmatic plan that provides field personnel with consistent policy, direction, and guidance for the management of state forested lands. It contains the general philosophies and management standards that will provide the framework for project-level decisions.

Planning for the South Fork Lost Creek project started before the SFLMP was adopted, so implementation of the SFLMP was phased into the project as it developed. DNRC made all reasonable attempts to incorporate the philosophy and standards of the SFLMP into this project.

III. THE ENVIRONMENTAL IMPACT STATEMENT PROCESS

A. Environmental Impact Statement Development

This environmental impact statement (EIS) was prepared in compliance with the Montana Environmental Policy Act (MEPA). MEPA requires state government to include consideration of environmental impacts into its decision-making process. It also requires agencies to inform the public and other interested parties about proposed projects, the environmental impacts that might result, and alternative actions that could achieve project objectives.

B. Public Scoping

The initial stage of an EIS is the public scoping process, which is used to inform the public that a state agency is proposing an action and to gather comments on the possible impacts of the project. The scope of this EIS was determined by the professional judgement of resource specialists in DNRC and other state and federal agencies, and by comments from the public and other interested parties. (Table 1.1).

TABLE 1-1. PUBLIC SCOPING

Date	Public Scoping Schedule
December 1994	The project proposal was mailed to interested individuals, owners of adjacent land, special interest groups, private industry, and federal and state agencies (Appendix A). Paid advertisements were published in local papers. The advertisements ran from December 7 thru December 11, 1994. A 30-day comment period began.
January 1995	Comments on the proposal were received from: one industry organization, one environmental group, and three members of the public.
Date	**Additional Public Involvement**
January 1995	DNRC reviewed comments and developed issue statements summarizing and incorporating issues raised. These issue statements were then sent to those who commented to ensure that their concerns were accurately represented.
April 1995	DNRC project leaders held a meeting with the foresters from Stoltze Lumber Co. to discuss and clarify their comments.
Date	**Formal Public Review**
October 1997	Draft EIS will be issued for public review and comment. Comments will be accepted for 30 days.
1997	Final EIS will be available for public review.
1997	The Record of Decision, which identifies and provides a rationale for the selected alternative, will be issued.

DNRC solicited public participation in the South Fork Lost Creek project on December 2, 1994 by distributing a project proposal to interested individuals, landowners, organizations, industries, and agencies.

This project was also advertised in the Kalispell Daily Interlake, the Seeley Lake Pathfinder, and the Bigfork Eagle. A commercial ad was published in the Bigfork Eagle on December 7; the Daily Interlake on December 9 and 11; and the Pathfinder.on December 8, 1994. DNRC accepted comments on the proposal for 30 days.

The mailing list for parties interested in the project is located in Appendix A. Public scoping comments are summarized in this chapter, with the originals located in Project Files 303 to 307 at the SRSF office.

C. Draft EIS

Following scoping, DNRC prepares a draft EIS incorporating public comments relating to issues that could affect the project. Immediately upon publication, the draft EIS is circulated to all those known to be interested. Comments are accepted for 30 days.

D. Final EIS

After all the public comments are received and evaluated, DNRC will prepare a final EIS, which will consist primarily of a revision of the draft EIS to incorporate new information based on public and internal comments.

E. Notification of Decision

Following publication of the final EIS, the Unit Manager of Swan River State Forest will review all of the information contained in the EIS and project file, including public comments. No sooner than 15 days after the publication of the final EIS, the Unit Manager will consider and determine the following:

1. Do the alternatives presented in the final EIS meet the project purpose?
2. Is the proposed mitigation adequate and feasible?
3. Which alternative should be implemented and why?

These determinations will be published in a decision notice/Record of Decision and distributed to all interested parties.

F. Proposed Schedule of Activities

After the decision is published and if a timber harvest alternative is selected, a contract package would be prepared. The package would then be sent to the Land Board for approval. If the Land Board approves, the timber sale would be advertised.

If the timber is sold, then the following schedule applies:

SRSF proposes to sell timber from the proposed project in July 1998. Timber harvesting and road construction/improvement work would begin in the fall of 1998 and be completed by April 15, 2000. Planting and hazard reduction work would be completed within 2 years follow-

ing completion of harvesting. Some activities would be restricted to certain periods of the year to avoid or reduce impacts (see chapter IV for mitigation information).

IV. OVERVIEW OF THE PROJECT

A. PROJECT AREA BOUNDARY

The criteria used for determination of size and location of the project area are:

- Area had not been entered for any major activity for 10 years.
- The project area would be contained to one Grizzly Bear Management Subunit, in compliance with Swan Valley Grizzly Bear Conservation Agreement (SVGBCA, discussed below) to reduce potential cumulative effects.
- The project would be limited to one watershed, minimizing any potential impacts to water quality and fisheries.
- The project would be limited to forest stands recommended for treatment and classified at risk in the SRSF Stand Level Inventory.
- The harvest area is large enough to allow harvesting of approximately 10 MMBF of timber in a variety of ways.

The South Fork Lost Creek Project is located in the northeast corner of the Swan River State Forest approximately 4 miles southeast of Swan Lake, Montana (Figure 1-2). The project area is limited to the South Fork of Lost Creek watershed and the South Fork Lost Soup Grizzly Bear Management Unit (BMU).

The project covers 4,306 acres and ranges in elevation from 3,360 feet where South Fork Lost Creek leaves the project area to a 7,238 foot un-named mountain peak located on the southeastern boundary of the project area. The project area consists of a steep, narrow canyon with rocky cliffs, limited access, avalanche chutes, heavy timbered slopes, subalpine terrain, and riparian areas along the South Fork of Lost Creek and small feeder streams.

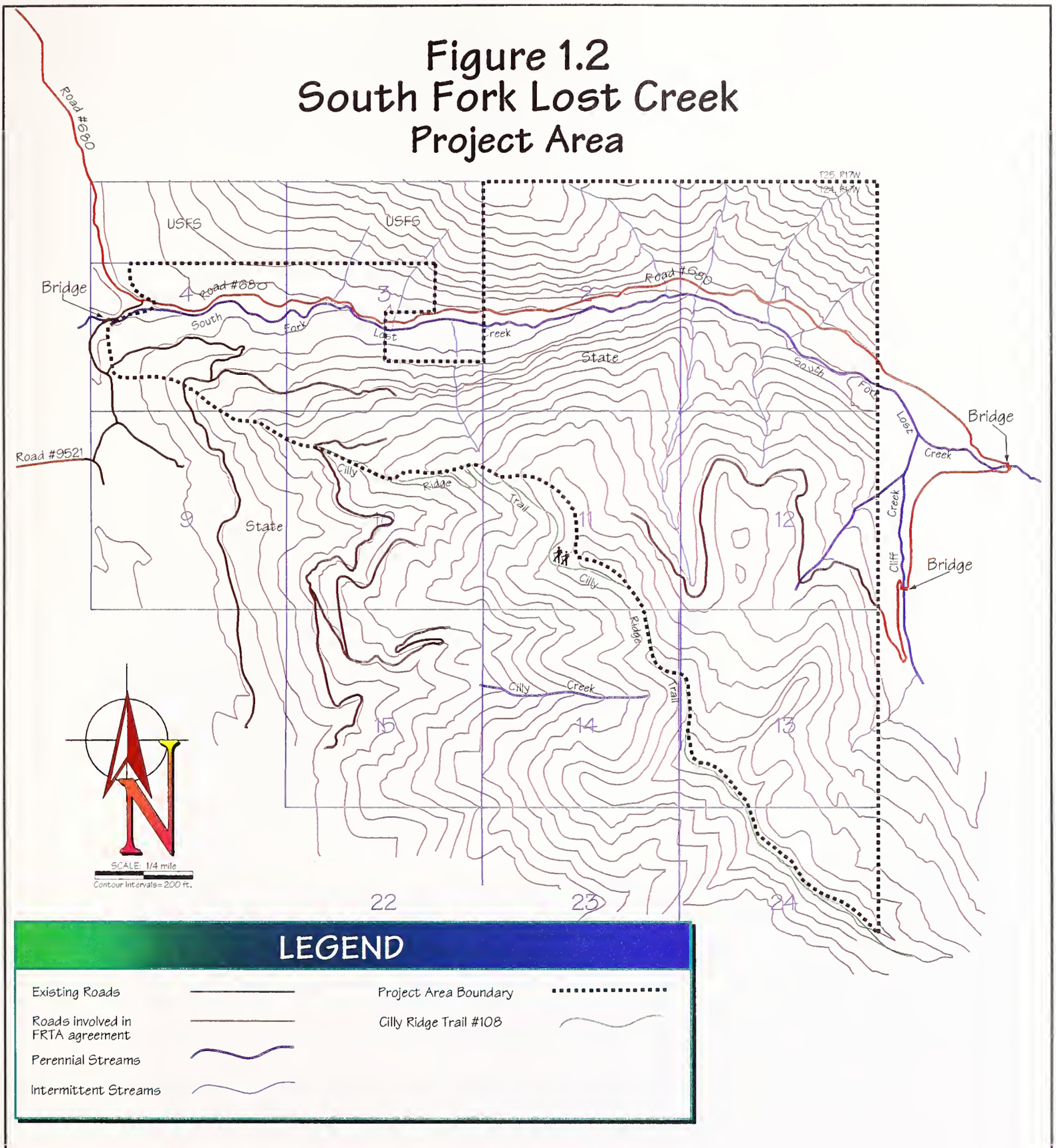
The project area is bordered on the north by a high ridge that runs east to west. Another ridge running roughly northwest-to-southeast borders the southern side. The western boundary of the project area lies between the ends of these ridges where they drop down to meet the main valley of the Swan River. The eastern boundary consists of the east boundary of the Swan River State Forest.

V. OTHER ENVIRONMENTAL REVIEWS RELATED TO THE PROJECT

A. THE SWAN VALLEY GRIZZLY BEAR CONSERVATION AGREEMENT

Beginning in December 1994, DNRC participated in the development of the Swan Valley Grizzly Bear Conservation Agreement (SVGBCA) with the U.S. Fish and Wildlife Service (USFWS), Flathead National Forest (FNF), and Plum Creek Timber Company (USFWS 1995b). The SVGBCA seeks to achieve cooperative management of grizzly bear habitat in the Swan valley where intermingled ownership patterns and differing land management objectives complicate habitat management for a species as wide-ranging as the grizzly bear.

Figure 1.2
South Fork Lost Creek
Project Area



LEGEND

- Existing Roads
- Roads involved in FRTA agreement
- Perennial Streams
- Intermittent Streams
- Project Area Boundary
- Cilly Ridge Trail #108

The U.S. Fish and Wildlife Service evaluated the SVGBCA in an environmental assessment and found that implementing the management guidelines in the agreement would not have a significant impact on the grizzly bear population (U.S. Fish and Wildlife Service 1995c). The South Fork Lost Creek Project Area is within the conservation area delineated in the SVGBCA. The agreement is summarized in Chapter 4.

B. Middle Soup Creek EIS

The scope of the South Fork Lost Creek EIS is influenced, and the content supplemented, by the Middle Soup EIS (DNRC 1997).

The Middle Soup Creek Project Area is located approximately 4 air-miles southwest of the South Fork Lost Creek Project Area. Effects of the two projects generally would not overlap, except possibly for air quality, and for animals that might move between the two areas, including grizzly bears, wolves, elk, and white-tailed deer (see Chapter 4 for a discussion of cumulative effects).

C. Cilly Creek EIS

The Cilly Creek Project Area is located adjacent to the south side of the South Fork Lost Creek project area. The project areas are separated by a high ridge that runs approximately east to west. Effects of the two projects probably would overlap on air quality, and on animals that might move between the two areas, including grizzly bears, wolves, elk, white-tailed and mule deer, moose and some sensitive species.



Photo 1 The east end of the South Fork Lost Creek project area, showing access road and avalanche chutes.

natives have not been developed. Quantitative data on cumulative effects were not available as the South Fork Lost Creek draft EIS was completed, but general information on anticipated effects are included in the effects assessment in Chapter 4.

VI. OTHER AGENCIES WITH JURISDICTION/ PERMITS REQUIRED

A. Cooperating Agencies

1. Department of Fish, Wildlife and Parks (DFWP)

DNRC has a contract with DFWP to collect data and monitor fisheries habitat and the status of bull trout and west slope cutthroat trout in SRSF streams. This monitoring is required by the Flathead Basin Commission. A DFWP fisheries biologist commented on fisheries in the South Fork of Lost Creek drainage and a DFWP wildlife biologist commented on the proposed project's short-term and long-term effects on white-tailed deer habitat.

2. United States Forest Service (USFS)

In June of 1995 the Northern Region USFS, the Bureau of Land Management (BLM), and DNRC entered into an agreement which would enable these parties to acquire reciprocal right-of-way easements across ownerships. This Memorandum of Understanding is based on the Federal Land Policy and Management Act of 1976 (as amended) and the National Forest Roads and Trails Act (FRTA) of 1964 (as amended).

Currently, the Flathead National Forest and the DNRC Northwestern Land Office are in the process of preparing an agreement which would grant the state an easement on USFS Road 9521 and both parties permanent easement rights to USFS Road 680 (South Fork Lost Creek road), which crosses through state and federal land (see Figures 2-2, 2-3 and 2-4 for road locations in each alternative.)

Included as part of this agreement, both roads would be reconstructed as necessary to meet the state Best Management Practice (BMP) standards for forest roads. Approximately 1.3 miles of USFS Road 680 would be relocated up-slope from its current location along the bank of the South Fork of Lost Creek (see Chapter 3, watershed, for more details).

B. Permits Required to Implement the Project

1. A Stream Preservation Act Permit (124 permit) is required from DFWP for activities that could affect any fisheries stream.

2. A short-term exemption from Montana's Surface Water Quality Standards (3A Authorization) is needed whenever temporary activities introduce sediment above natural levels into live streams. This permit from the Montana Department of Environmental Quality (DEQ) would be needed for one bridge replacement, two bridge removals, and some culvert installations.

VII. PUBLIC CONCERNS

Through the scoping process, the public raised concerns about the potential impacts of the project on the environment. DNRC used these public concerns in developing alternatives (see Chapter 2). A paraphrased summation of comments that were incorporated into alternatives is presented below.

A. VEGETATION

Ecosystem Characteristics The public felt that timber harvesting would reduce the total area of forest, could alter the ecological characteristics of forested stands in the project area, and might reduce the structural and compositional diversities that stands require to function as natural ecosystems. Further, existing stands might be fragmented and edge effects might increase beyond levels acceptable for the maintenance of natural biological diversity.

Old-Growth - The public indicated that the character of old growth stands in the project area might be significantly altered and the connections of those stands with adjacent old growth stands could be affected. Also, the public felt that timber harvesting might ruin the opportunity to use existing old growth stands as "outdoor classrooms" where the ecological uniqueness of old growth forests could be studied.

Timber Value - The public commented that mitigation to reduce impacts to resources other than timber might compromise forest productivity and the potential for timber sales to support school trusts.

Special Status Plants - The public felt that timber harvesting might threaten sensitive species such as the water howellia (*Howellia aquatillis*), a threatened aquatic plant that occurs in the Swan valley.

B. WILDLIFE

Grizzly Bear - The public expressed several concerns regarding grizzly bears: a) that previous land management activities may have reduced the grizzly bear population in and around the project area; b) that past road building has increased human use of the area, which could increase bear mortality and displace bears from biologically suitable habitats; and c) that the exclusion of bears from the project area could further isolate grizzly bears in the Mission Mountains.

Elk and White-Tailed Deer The public indicated that a) timber harvesting could either benefit or harm elk and white-tailed deer populations; b) tree removal might reduce availability of hiding and thermal cover; and c) road construction and improvement might reduce security by increasing vulnerability to hunters.

Old Growth Associated Species - The public expressed concern that the proposed project might adversely affect wildlife species that are closely associated with old growth.

Cavity-Dependent Species - The public felt that any loss of snags and decayed trees that cavity-dependent species use for nesting, roosting, feeding, and shelter could reduce the populations of such species in the project area.

Fisheries - The public indicated that populations of bull trout and westslope cutthroat trout might be harmed if water quality is affected.

C. Water Quality

The public expressed concern that a) timber harvest might increase water yields and sedimentation; b) the quality of water in the immediate area and downstream might be affected; and c) any reduction in water quality would affect fish.

D. Soil

The public indicated that timber harvest might cause soil rutting, compaction, displacement, and loss of productivity.

E. Recreation

The public felt that the Cilly Ridge Trail should be protected from the effects of timber harvest.

F. Cultural Resources

The public expressed concern that timber harvest might cause irreparable harm to any historical or archaeological resources in the project area.

VIII. Issues Outside the Scope of This Project

The following concerns were evaluated and would not be affected by the project for the reasons stated.

A. Recreation

The Cilly Ridge Trail # 108 starts in the NW 1/4 section 10, T24NR17W and 1 mile of it extends along the sharp ridge top that forms the southern border of the project area. No timber harvesting is proposed along this trail.

B. Cultural Resources

A DNRC archaeologist examined the project area for historical or archaeological resources but none were found. Mitigating measures would be implemented if any such resources were found during further examination or during project activities (See Chapter 4).

CHAPTER 2

ALTERNATIVES

I. DEVELOPMENT OF ALTERNATIVES

Development of alternatives began in December 1994 when DNRC developed a project proposal describing the proposed action and project timeline. The proposal was sent for review and comment to interested members of the public, adjacent landowners, and other state and federal agencies. Comments were accepted for a 30-day period.

An interdisciplinary team (ID team) was formed to work on the project. The role of the ID team was to develop the project and analyze the potential impacts on the human and natural environment. The ID team reviewed the comments that were received and used them in developing three timber-harvest alternatives and a no-action alternative. The timber-harvest alternatives are intended to simulate many of the ecological functions that would result from unsuppressed wildfire and other natural disturbances. Silvicultural treatments are intended to promote natural patch sizes, shapes, connectivity, structural diversity and species composition. The timber-harvest alternatives incorporate guidance from the State Forest Land Management Plan (SFLMP) Resource Management Standards, the Swan Valley Grizzly Bear Conservation Agreement (SVGBCA), Best Management Practices (BMP), Streamside Management Zone (SMZ) rules, Flathead Basin Commission recommendations, and other laws, rules and regulations.

The no-action alternative is included as a baseline for comparing the environmental consequences of the three timber-harvest alternatives. The no-action alternative is considered a viable alternative for selection.

II. ALTERNATIVES

This section describes the no-action alternative and the three timber-harvest alternatives. Mitigating measures common to all timber-harvest alternatives are outlined in Chapter 4. The silvicultural treatments that would be employed under the alternatives are described later in this chapter.

A. No-action Alternative

ALTERNATIVE A

Alternative A is the no-action alternative. If this alternative were selected, no timber harvesting would occur in the project area. Land management activities, such as timber-harvesting, could be proposed and undertaken in the future following the appropriate level of MEPA review. Management activities, such as fire suppression and road maintenance would continue. Figure 2.1 shows the project area as it would continue to exist under Alternative A.

B. Timber-harvest Alternatives

Silvicultural Guidelines

The following guidelines were used in the development of all of the timber-harvest alternatives:

- The alternative would provide approximately 10 MMBF of timber.
- Long-term timber productivity would be maintained or enhanced.
- The natural role of wildfire in this area would be simulated through the application of silvicultural treatments to promote natural diversity of stand structure species composition.
- Proposed harvest units would be located adjacent to previously harvested units to create groups of young-age stands, similar to what would occur naturally due to wildfires.
- Road construction would be minimized by location of harvest units and use of logging systems that would require the least amount of road.

Road Management

All of the timber-harvest alternatives would include closure of a 1.3-mile segment of the South Fork Lost Creek road in Sections 3 and 4 of T23N, R17W, where it is too close to the South Fork of Lost Creek and presents a potential sediment source. The closed segment would be replaced with a new segment of about 1.7 miles, approximately 100-200 feet up-slope from the existing roadbed.

ALTERNATIVE B

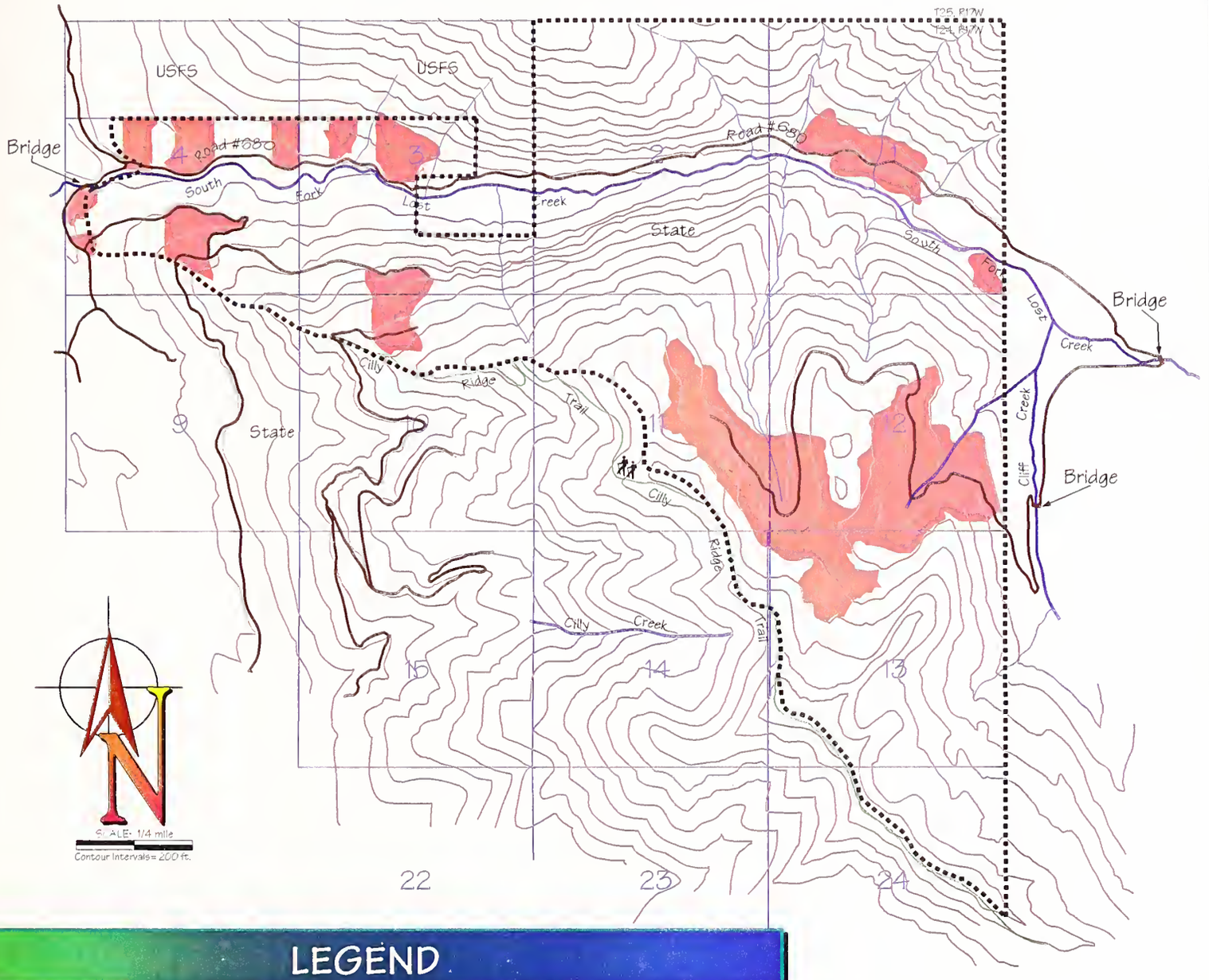
Alternative B would harvest approximately 9.8 MMBF from 615 acres. It would require 1.3 miles of new road to provide access to units 5, 6, 7, 9 and 10 (Figure 2.2).

This alternative incorporates specific criteria developed to address public comments that the proposed project should maintain wildlife habitat, especially for old-growth-associated species. These criteria were used in determining this alternative's harvest unit design, location and silvicultural treatments:

- Minimize harvesting in high quality, sensitive species habitat.
- Maintain wildlife corridors for north-south movement, and along riparian areas.
- Minimize harvesting in the largest blocks of old stands.
- Maintain old stands with the highest values for old growth associated species.
- Target, as highest priority for harvesting, stands that have poor tree quality, poor vigor and/or exhibit major insect and disease problems.
- Consider, as a lower priority for harvesting, other stands that have higher tree quality vigor and/or may not exhibit insect and disease problems.

Sixteen harvest units are included in this alternative for a total of about 615 acres. Three silvicultural treatments–heavy-reserve, moderate-reserve, light-reserve–would be applied to these units (a thorough discussion of the methods and objectives of the silvicultural treatments follows the discussion of alternatives, later in this chapter).

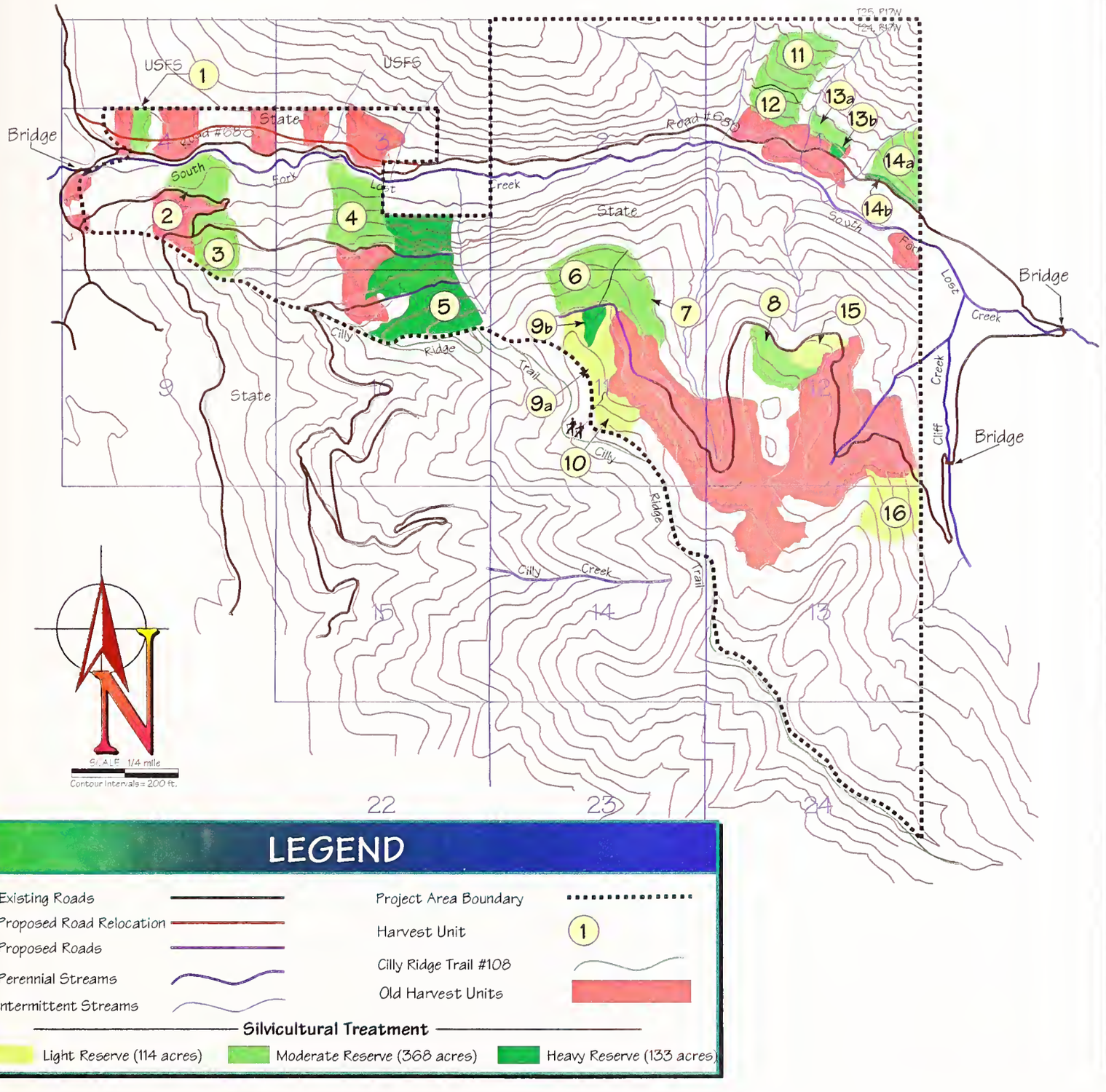
Figure 2.1
South Fork Lost Creek
Alternative A – No-Action



LEGEND

Existing Roads		Project Area Boundary	
Perennial Streams		Cilly Ridge Trail #108	
Intermittent Streams		Old Harvest Units	

Figure 2.2
South Fork Lost Creek
Alternative B



LEGEND

Existing Roads	Project Area Boundary
Proposed Road Relocation	Harvest Unit (1)
Proposed Roads	Cilly Ridge Trail #108
Perennial Streams	Old Harvest Units
Intermittent Streams	

Silvicultural Treatment

Light Reserve (114 acres) — Moderate Reserve (368 acres) — Heavy Reserve (133 acres)

HEAVY-RESERVE

The heavy-reserve treatment would be applied to units 5, 9a, 13b and 14b. These units are currently stocked with Douglas-fir, western larch, cedar, subalpine fir and spruce.

- Unit 5 (133 acres) would receive heavy-reserve treatment to help maintain the integrity of an existing north-south wildlife corridor. Preservation of this stand would help maintain the integrity of large, contiguous blocks of old stands and old growth stands.
- Unit 9a is an 8-acre section of Unit 9 that would be treated to maintain a visual buffer for grizzly bears in compliance with the Swan Valley Grizzly Bear Conservation Agreement (SVGBCA).
- Units 13b (.7 acres) and 14b (7.1 acres) would be treated so as to leave a visual buffer along the South Fork Lost Creek road.

MODERATE-RESERVE

The moderate-reserve treatment would be applied to Units 1, 2, 3, 4, 6, 7, 8, 11, 12, 13a and 14a. These units are stocked with Douglas-fir, Douglas-fir/larch, cedar, subalpine fir and spruce.

- Units 1, 2, 3, 4 and 8 (totaling 159.3 acres) were identified through the Stand Level Inventory (SLI) as high risk and fair-to-poor/very poor vigor. These units were selected for moderate-reserve treatment to improve timber productivity by removing competing trees to promote regeneration of western larch, ponderosa pine and western white pine. The location of these stands would help maintain the integrity of large contiguous blocks of old stands and old growth stands.
- Units 6 and 7 (totaling 96.3 acres) were placed around previously harvested cutting units to minimize fragmentation.
- Units 11, 12, 13a and 14a (totaling 112.3 acres) were selected for harvest to remove competing tree species and promote regeneration of western larch, ponderosa pine and white pine.

LIGHT-RESERVE

The light-reserve treatment would be applied to Units 9b, 10, 15 and 16. These units are currently stocked with Douglas-fir, subalpine fir and spruce.

- Units 9b and 10 (totaling 60.3 acres) were placed around existing harvest units to minimize fragmentation.
- Unit 15 (9.3 acres) was identified through the Stand Level Inventory (SLI) as high risk and fair-to-poor/very poor vigor. This unit was selected for light-reserve treatment to convert the existing cover type to western larch, and ponderosa pine. The location of this stand would help maintain the integrity of large contiguous blocks of old stands and old growth stands.
- Unit 16 (44.7 acres) was selected for light-reserve treatment to convert the existing cover type to western larch, and western white pine and ponderosa pine.

ALTERNATIVE B SUMMARY						
UNIT #	TOTAL ACRES	TREATMENT	HARVEST METHOD	HARVEST VOLUME	SITE PREPARATION	REGENERATION METHOD AND SPECIES*
1	11.3	Moderate Reserve	Tractor	263.1	Machine Pile & Scarification	Full Plant: PP
2	36.4	Moderate Reserve	Tractor/ Cable	398.9	Machine Pile & Scarification	Partial Plant: WL, WP
3	36.4	Moderate Reserve	Cable/ Tractor	465	Broadcast Burn	Partial Plant: WL, WP
3	54.7	Moderate Reserve	Cable/ Heli	1,372.8	Broadcast Burn	Partial Plant: WL, WP
5	117.3	Heavy Reserve	Soft Track/ Cable	1,295.9	Machine Pile & Scarification	Natural
6	54.0	Moderate Reserve	Cable	1,490.2	Broadcast Burn	Full Plant: WL, LP
7	42.3	Moderate Reserve	Cable	673.6	Broadcast Burn	Partial Plant: WL, WP
6	26	Moderate Reserve	Tractor	458.8	Machine Pile & Scarification	Partial Plant: WL, LP
9b	41.4	Light	Tractor	557.3	Machine Pile & Scarification	Full Plant: WL, LP
9b	8	Heavy				
12	19.8	Light Reserve	Soft Track	442.4	Machine Pile & Scarification	Full Plant: WL, LP
11	50.3	Moderate Reserve	Heli	458.8	Broadcast Burn	Partial Plant: WL, WP, PP
12	19.8	Moderate Reserve	Soft Track	158.3	Broadcast Burn	Partial Plant: WL, WP, PP
14a	12.0	Moderate	Soft Track	130.5	Machine Pile & Scarification	Partial Plant: WL, WP, PP
13b	.7	Heavy				
14a	30.2	Moderate	Heli/ Soft Track	547.6	Broadcast Burn	Partial Plant: WL, WP, PP
14b	7.1	Heavy				
15	9.3	Light Reserve	Tractor	151.1	Machine Pile & Scarification	Full Plant: WL, LP
16	44.7	Light Reserve	Heli	603.5	Broadcast Burn	Full Plant: WL, WP
Total Acres Treated	615.3			9,491.5		

PP=Ponderosa Pine LP=Lodge Pole WL=Western Larch WP= White Pine

*Selection of species to be planted depends on site characteristics and availability of seedlings.

ALTERNATIVE C

Alternative C would harvest approximately 10 MMBF from 668 acres. It would require 1.9 miles of new road to provide access to Units 2, 3, 6, 8 and 10 (Figure 2.3).

This alternative incorporates specific criteria developed to address public comments that the proposed project should maintain existing old growth. These criteria were used in determining this alternative's harvest unit design, location and silvicultural treatments:

- No harvesting of stands identified in the SLI as old growth.
- Target, as highest priority for harvesting, non old growth stands that have poor tree quality, poor vigor and/or exhibit major insect and disease problems.
- Consider, as a lower priority for harvesting, other non old growth stands that have higher tree quality vigor and/or may not exhibit insect and disease problems.
- Maintain an existing low elevation east-west wildlife travel corridor along the South Fork of Lost Creek.
- Maintain north-south wildlife travel corridors between lower and higher elevations within the project area.
- Maintain an existing low elevation north-south wildlife travel corridor on the west side of the project area.

Eighteen harvest units are included in this alternative for a total of about 668 acres. Three silvicultural treatments--heavy-reserve, moderate-reserve, light-reserve--would be applied to these units (a thorough discussion of the methods and objectives of the silvicultural treatments follows the discussion of alternatives, later in this chapter).

HEAVY-RESERVE

The heavy-reserve treatment would be applied to Units 7, 12b, 17b and 18. These units are currently stocked with Douglas-fir, western larch, cedar, subalpine fir and spruce.

- Units 7 and 18 (totaling 209.7 acres) would receive heavy-reserve treatment to create openings that would promote growth and natural regeneration of tree species that are there now.
- Units 12b and 17b (totaling 4.5 acres) would be treated so as to leave a visual buffer along the South Fork Lost Creek road.

MODERATE-RESERVE

The moderate-reserve treatment would be applied to Units 1, 2, 3, 4, 5, 6, 12a, 13, 14, 15, 16, and 17a. These units are stocked with Douglas-fir, Douglas-fir/larch, whitepine, cedar, subalpine fir and grand fir.

- Units 1, 2, 5, and 6 (totaling 61.9 acres) were identified through the SLI as high risk and fair-to-poor/very poor vigor. These units were selected for moderate-reserve treatment to improve timber productivity by removing competing trees and promoting regeneration of western larch, Douglas-fir, lodgepole pine and western white pine. Units 1 and 2 were located next to previously harvested cutting units to reduce fragmentation.
- Units 3, 4, 12a, 13, 14, 15, 16 and 17a (totaling 299.1 acres) were selected for moderate-reserve treatment to improve the vigor of the stands by removing competing trees and promote regeneration of western larch, Douglas-fir, lodge-

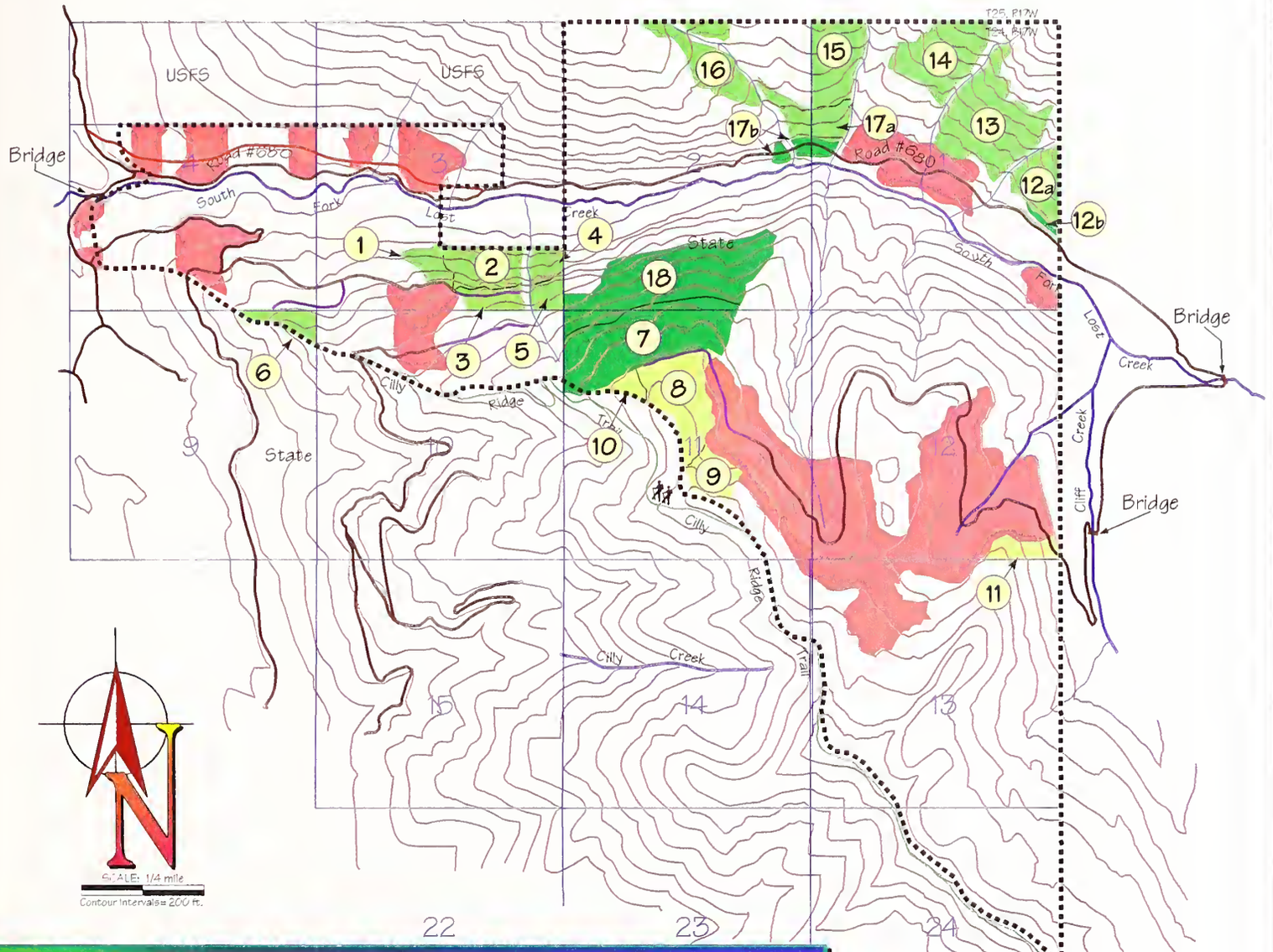
pole pine and western white pine. Unit 13 was located next to a previously harvested cutting unit to reduce fragmentation.

LIGHT-RESERVE

The light-reserve treatment would be applied to Units 8, 9, 10, and 11. These units are currently stocked with Douglas-fir, subalpine fir and spruce.

- Units 8 and 9 (totaling 70 acres) were placed around previously harvested units to minimize forest fragmentation. They were selected for light-reserve treatment to convert the existing cover type to western larch and lodgepole pine.
- Units 10 and 11 (totaling 22.7 acres) were selected for light-reserve treatment to convert the existing cover type to western larch, western whitepine and lodgepole pine.

Figure 2.3
South Fork Lost Creek
Alternative C



LEGEND

- Existing Roads
- Proposed Road Relocation
- Proposed Roads
- Perennial Streams
- Intermittent Streams
- Project Area Boundary
- Harvest Unit (1)
- Cilly Ridge Trail #108
- Old Harvest Units

Silvicultural Treatment

- Light Reserve (93 acres)
- Moderate Reserve (361 acres)
- Heavy Reserve (214 acres)

ALTERNATIVE C SUMMARY						
UNIT #	TOTAL ACRES	TREATMENT	HARVEST METHOD	HARVEST VOLUME (MMBF)	SITE PREPARATION	REGENERATION METHOD AND SPECIES*
1	11.3	Moderate Reserve	Cable	54.4	Broadcast Burn	Partial Plant: WL, WP
2	28.2	Moderate Reserve	Cable	610.1	Broadcast Burn	Partial Plant: WL, WP
4	14.9	Moderate Reserve	Soft Track	261.0	Machine Pile & Scarification	Partial Plant: WL, WP
4	14.9	Moderate Reserve	Heli	216.2	None	Full Plant: WL, WP
5	11.3	Moderate Reserve	Heli	245.0	None	Full Plant: WL, WP
6	11.1	Moderate Reserve	Soft Track	268.0	Machine Pile & Scarification	Partial Plant: WL, WP
7	100.5	Heavy Reserve	Cable	1,817.5	None	Natural
8	51.1	Light Reserve	Tractor	611	Machine Pile & Scarification	Full Plant: LP, WL
9	18.9	Light Reserve	Tractor	442.4	Machine Pile & Scarification	Full Plant: LP, WL
10	8.9	Light Reserve	Tractor	200.5	Machine Pile & Scarification	Full Plant: LP, WL
11	13.8	Light Reserve	Soft Track	186.1	Machine Pile & Scarification	Full Plant: WL, WP
12a	28.5	Moderate	Heli	510.8	Broadcast Burn	Partial Plant: WL, WP
12b	.9	Heavy				
13	81.1	Moderate Reserve	Heli	1,097.0	Broadcast Burn	Partial Plant: WL, WP, LP
14	52.3	Moderate Reserve	Heli	501.7	None	Full Plant: WL, WP, LP
15	40.9	Moderate Reserve	Heli	720.2	Broadcast Burn	Partial Plant: WL, WP
16	45.8	Moderate Reserve	Heli	407.2	None	Full Plant: LP, WL
17a	25.6	Moderate	Soft Track	369	Broadcast Burn	Partial Plant: WL, WP
17b	3.6	Heavy				
18	109.2	Heavy Reserve	Heli	1472.5	None	Natural
Total Acres Treated	667.9			9980.6		

PP=Ponderosa Pine WL=Western Larch P=White Pine LP=Lodgepole

*Selection of species to be planted depends on site characteristics and availability of seedlings.

ALTERNATIVE D

Alternative D would harvest approximately 10 MMBF from 695 acres. It would require 1.7 miles of new road to provide access to Units 3, 4, 5 (Figure 2.4).

This alternative incorporates specific criteria to promote timber productivity in high risk, low vigor stands. These criteria were used in determining harvest unit design, location and silvicultural treatments:

- Harvest only within stands that have the highest risk of value loss through mortality, poor to very poor vigor, poor tree quality and/or exhibit major insect and disease problems.
- Apply silvicultural treatments that would contribute to optimizing future timber productivity within stands treated.
- Harvest priorities and silvicultural treatments would be modified to maintain important wildlife travel corridors and contiguous blocks of old stands and old growth, to the extent timber productivity would not be overly compromised.

Ten harvest units are included in this alternative for a total of about 668 acres. Four silvicultural treatments--structural enhancement, heavy-reserve, moderate-reserve, light-reserve--would be applied to these units (a thorough discussion of the methods and objectives of the silvicultural treatments follows the discussion of this alternative).

STRUCTURAL ENHANCEMENT

The structural enhancement treatment would be applied to Unit 1. This unit is currently stocked with Douglas-fir and western larch.

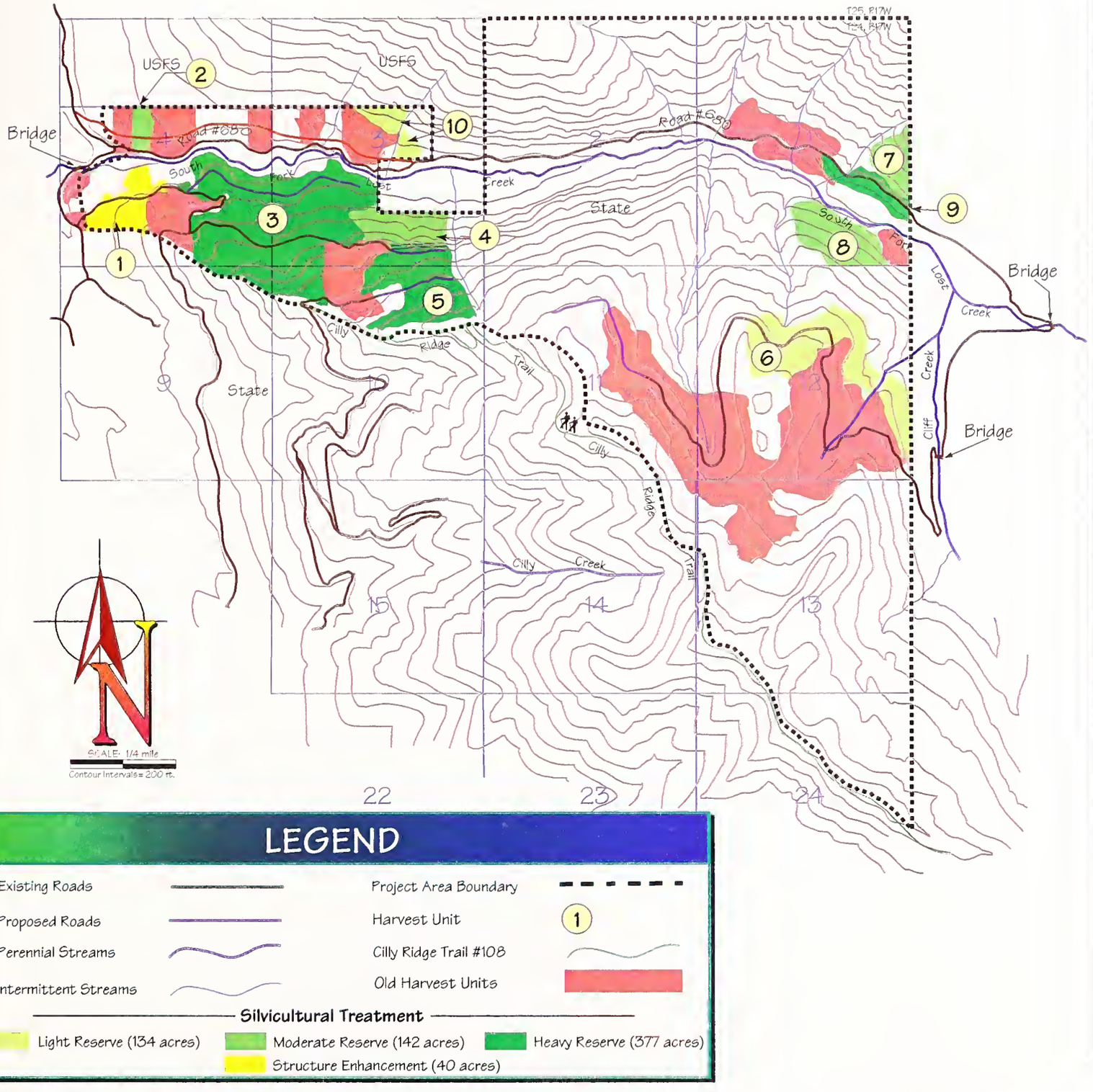
- Unit 1 (40.2 acres) was identified through the SLI as high risk and fair-to-poor/very poor vigor. The structural enhancement treatment would be applied to maintain the integrity of an existing low elevation north-south wildlife travel corridor and possibly to improve pileated woodpecker habitat.

HEAVY-RESERVE

The heavy-reserve treatment would be applied to Units 3, 5 and 9b. These units are currently stocked with Douglas-fir, Douglas-fir/larch and western white pine, spruce, subalpine fir and cedar.

- Units 3 and 5 (totaling 349.6 acres) were identified through the SLI as high risk and fair-to-poor/very poor vigor and were located next to previously harvested units to reduce forest fragmentation and to minimize impact to existing north-south wildlife travel corridors. These units would receive heavy reserve treatment to create openings that would promote growth and natural regeneration of tree species that are there now.
- Unit 9b (28 acres) would be treated so as to leave a visual buffer along the South Fork Lost Creek road.

Figure 2.4
South Fork Lost Creek
Alternative D



LEGEND

Existing Roads	Project Area Boundary
Proposed Roads	Harvest Unit (1)
Perennial Streams	Cilly Ridge Trail #108
Intermittent Streams	Old Harvest Units

Silvicultural Treatment

- Light Reserve (134 acres)
- Moderate Reserve (142 acres)
- Heavy Reserve (377 acres)
- Structure Enhancement (40 acres)

MODERATE-RESERVE

The moderate-reserve treatment would be applied to Units 2, 4, 7, 8 and 9a. These units are stocked with Douglas-fir, western larch, cedar, and grand fir.

- Units 2, 4, 7 and 8 (totaling 136.1) were identified through the SLI as high risk and fair-to-poor/very poor vigor. Unit 2 was located between two previously harvested cutting units and Unit 1 next to a previously harvested unit to reduce fragmentation. These four units were selected for moderate-reserve treatment to simulate a moderate intensity stand replacing fire. This treatment was selected to improve growth and regeneration of Douglas-fir, western larch and cedar, and to address insect and disease conditions such as bark beetle, blister rust and Indian paint fungus.
- Unit 9a (6 acres) was selected for moderate-reserve treatment to improve the vigor of the stands and promote regeneration of western larch, Douglas-fir and cedar by removing competing trees.

LIGHT-RESERVE

The light-reserve treatment would be applied to Units 6 and 10. These units are currently stocked with grand fir, spruce, western larch and Douglas-fir.

- Units 6 and 10 (totaling 134.5 acres) were placed around previously harvested units to minimize fragmentation of the forest. They were selected for light-reserve treatment to simulate a high-intensity, stand replacing fire that would convert the existing cover type to western larch and Douglas-fir, and to address insect and disease conditions such as bark beetle, blister rust and Indian paint fungus.

ALTERNATIVE D SUMMARY						
UNIT #	TOTAL ACRES	TREATMENT	HARVEST METHOD	HARVEST VOLUME (MMBF)	SITE PREPARATION	REGENERATION METHOD AND SPECIES*
1	40.2	Structural Enhancement	Tractor	118.2	None	Natural
2	11.3	Moderate Reserve	Tractor	263.1	Machine Pile & Scarification	Full Plant: PP
3	260.4	Heavy Reserve	Tractor & Cable	3,585.0	Machine Pile & Scarification	Natural
4	39.5	Moderate Reserve	Cable/ Soft Track	664.5	Broadcast Burn	Full Plant WL, WP
5	89.2	Heavy Reserve	Soft Track	914.6	Machine Pile & Scarification	Natural
6	116.0	Light Reserve	Tractor/ Cable/Heli	2,486.7	Broadcast Burn	Full Plant WL
7	28.5	Moderate Reserve	Heli	501.0	Broadcast Burn	Part Plant WL, WP
8	56.8	Moderate Reserve	Heli	982.4	Broadcast Burn	Part Plant WL, WP
9a	6	Moderate	Tractor	188.2	Machine Pile & Scarification	Part Plant WL, WP
9b	28	Heavy Reserve				
10	18.5	Light Reserve	Soft Track	267.1	Machine Pile & Scarification	Full Plant PP
Total Acres Treated	694.4			9,970.8		

PP=Ponderosa Pine WL=Western Larch WP=White Pine

*Selection of species to be planted depends on site characteristics and availability of seedlings.

III. SILVICULTURAL TREATMENTS

The timber-harvest alternatives employ combinations of four different silvicultural treatments. The treatments proposed for the South Fork Lost Creek project have been designed to simulate the historical effects of natural fires and are intended to promote natural levels of structural and compositional diversity.

A. LIGHT-RESERVE, REGENERATION HARVEST

1. HARVESTING

Light-reserve, regeneration harvesting simulates many of the effects of a high-intensity, stand-replacing fire. Such a fire would greatly alter the structure and composition of overstory and understory vegetation. Light-reserve treatment would remove most of the overstory and understory vegetation within cutting units. Hiding and thermal cover would not be retained; however, the following important stand components would be reserved when available:

a) Approximately two large trees per acre with an average diameter of about 22 inches. Preferred reserve trees include western larch (*Larix occidentalis*), Douglas-fir (*Pseudotsuga menziesii*) and ponderosa pine (*Pinus ponderosa*)--all of which have a high resistance to fire and wind. Reserve trees provide for structural diversity and future snag recruitment. They would have intact crowns and represent the healthiest trees available, but might not always meet seed tree quality. Reserved trees should not be likely to spread disease. (On slopes greater than 50 percent, some reserve trees might be damaged by broadcast burning of logging slash).

b) Small, scattered clumps of healthy, residual understory.

c) Approximately two live trees with broken boles per acre, that would not be likely to spread disease.

d) Dead, standing trees that do not qualify as hazards under regulations of the Office of Safety and Health Administration (OSHA).

e) Fifteen to twenty tons per acre of large, down, woody material. Fifty percent of the down woody material would be 16 feet or longer.

Retention of stand components would depend on their presence, health, and vigor. Stand components would be reserved in various, naturally-occurring shapes and sizes. The residual stand would average 10 square feet in basal area per acre and have approximately 11 percent crown cover.

2. SLASH DISPOSAL AND SITE PREPARATION

Slash disposal to reduce the fire hazard and prepare the site for regeneration would be accomplished by using one or a combination of the following methods. On slopes less than 50 percent, excavator-piling and hand burning of slash would be the preferred method of slash disposal. On slopes greater than 50 percent, broadcast burning would be preferred. Both methods might be used on units where some slopes are greater than 50 percent and some less.

Restricted access to portions of units with slopes less than 50 percent could preclude the use of machines to pile slash. Broadcast burning would be considered for these areas.

Broadcast burning would be accomplished by hand burning or with a helitorch. Whole tree yarding would only be considered on units that do not lend themselves to excavator-piling or broadcast burning and that exceed the tons per acre requirements of the hazard reduction agreement.

a) **Site preparation for regeneration on slopes less than 50 percent**

Mineral soil would be exposed on 30 to 40 percent of the site. Scarification would be accomplished with an excavator-piler. The soil would be scarified over the entire site in randomly-spaced patches varying in size. Care would be taken to preserve huckleberry bushes and their root systems.

b) **Site preparation for regeneration on slopes greater than 50 percent**

The duff layer would be reduced over 20 to 30 percent of the site. Site preparation would be accomplished by broadcast burning. Slash would be cleared from around the bases of reserve trees to help prevent scorching and damage to the trees.

3. Regeneration

Prepared sites would favor the establishment of shade-intolerant species. The establishment of shade-intolerant species would contribute to structural and compositional diversity by promoting the long-term presence of many species with varying degrees of shade tolerance.

Regeneration would establish primarily from adjacent stands. Natural regeneration would be supplemented by interplanting western white pine (*Pinus monticola*) that is resistant to white pine blister rust. Interplanting healthy, rust-resistant western white pine would promote its continued presence in the project area. Western larch, ponderosa pine, and lodgepole pine also are viable species that would be considered for interplanting to supplement natural regeneration.

B. Moderate-Reserve, Regeneration Harvest

1. Harvesting

Moderate-reserve, regeneration harvesting simulates the effects of either a moderate-intensity, stand-replacing fire, or a hot, mixed severity fire. Either type of fire would greatly alter the structure and composition of both overstory and understory vegetation. . Moderate-reserve treatment would remove most overstory and understory vegetation within cutting units. Hiding and thermal cover would not be retained, but the following important stand components would be reserved when available:

a) Approximately six large (at least 20 inches dbh), healthy, seed trees with straight boles and good crown development per acre. Preferred reserve tree species would include western larch, Douglas-fir, and ponderosa pine. Depending on availability, reserved trees would be scattered at random or reserved in groups.

(On slopes greater than 50 percent, some of the reserve trees might be damaged by broadcast burning of logging slash.)

b) Small, scattered clumps of healthy understory.

c) Approximately two live trees with broken boles per acre that would not be likely to spread disease.

d) Dead, standing trees that do not qualify as hazards under OSHA regulations.

e) Fifteen to twenty tons per acre of large, down, woody material. Fifty percent of the down woody material would be at least 16 feet long.

As with light-reserve treatment, the retention of these stand components would depend on their presence, health, and vigor. Stand components would be reserved in various, naturally-occurring shapes and sizes. The residual stand remaining after moderate-reserve treatment would average 21 square feet of basal area and have approximately 18 percent crown cover.

2. Slash Disposal and Site Preparation for Regeneration

Slash disposal to reduce the fire hazard and prepare the site for regeneration would be accomplished with one or a combination of the following methods. On slopes less than 50 percent, excavator-piling and hand burning of slash would be preferred. On slopes greater than 50 percent, broadcast burning would be preferred. Both of these methods may be used on units where some slopes are greater than 50 percent and some less. Restricted access to portions of units with slopes less than 50 percent could preclude the use of machines to pile slash. Broadcast burning would be considered for these areas.

Broadcast burning would be accomplished by hand burning or with a helitorch. Whole-tree yarding would be considered only on units that do not lend themselves to excavator-piling or broadcast burning and that exceed the tons per acre requirements of the hazard reduction agreement.

a) **Site preparation for regeneration on slopes less than 50 percent**

Mineral soil would be exposed on 30 to 40 percent of the site. Scarification would be accomplished with an excavator-piler. The soil would be scarified over the entire site in randomly-spaced patches varying in size. Care would be taken to preserve huckleberry bushes and their root systems.

b) **Site preparation for regeneration on slopes greater than 50 percent**

The duff layer would be reduced over 20 to 30 percent of the site. Site preparation would be accomplished by broadcast burning. Slash would be cleared from around the bases of reserve trees to help prevent scorching and damage to the trees.

3. Regeneration

The prepared site would favor the establishment of shade-intolerant species. The establishment of shade-intolerant species would promote long-term structural and compositional diver-

sity. Regeneration would establish by seed from reserve trees and adjacent stands. As with light-reserve treatment, natural regeneration would be supplemented by interplanting rust-resistant western white pine. Western larch, ponderosa pine, and lodgepole pine also are viable species that would be considered for interplanting to supplement natural regeneration.

C. Heavy-Reserve, Regeneration Harvest

1. Harvesting

Heavy-reserve regeneration harvesting simulates the effects of a ground fire with varying intensity. Such a fire would alter stand density and species composition of overstory and understory vegetation. Heavy-reserve treatment would remove 20 to 70 percent of the overstory trees in a cutting unit, depending on the stand density. Currently the basal area of mature stands in the project area ranges from 100 to 300 square feet per acre; heavy-reserve treatment would reduce basal area to approximately 80 square feet. Trees would be removed singly, in groups, or in strips not larger than 0.5 acre. The largest diameter shade-intolerant species would be favored for retention, but some of all existing species would be reserved. Live trees with broken boles and dead standing trees that do not qualify as hazards under OSHA regulations would be reserved. Fifteen to twenty tons of large, down, woody material also would be reserved. Fifty percent of the down woody material would be at least 16 feet long. The residual stands would maintain an average crown cover of approximately 70 percent. Hiding and thermal cover would be retained.

2. Slash disposal and preparation of sites for regeneration

Slash disposal would be accomplished by excavator-piling and hand-burning.

To prepare the site for regeneration, mineral soil would be exposed on 20 to 30 percent of the site. Scarification would be accomplished with the excavator-piler. Where patches, groups, or stringers of trees were removed, the soil would be scarified in randomly-spaced patches varying in size. Care would be taken to preserve huckleberry bushes and their root systems.

3. Regeneration

The prepared site would promote establishment of both shade-tolerant and shade-intolerant species thus promoting long-term structural and compositional diversity. Regeneration would establish by seed from the residual overstory. Natural regeneration could be supplemented by interplanting western larch, ponderosa pine, and rust-resistant western white pine.

D. Structural Enhancement

1. Thinning

Structural enhancement simulates the effect of multiple, scattered, low-intensity ground fires. Such fires would alter stand density and species composition primarily in the lower canopy layer. Understory vegetation would be lightly disturbed. Structural enhancement would reduce the basal area of stands by approximately 10 percent. Half-acre patches would be selectively thinned throughout the stand. Patches would be selected for thinning where shade-tolerant species are encroaching on shade-intolerant species.

To further simulate the effects of low-intensity ground fire, thinning within patches would remove shade-tolerant trees with thin bark and crowns low to the ground. Some shade-intolerant species would be removed to improve spacing and extend the presence of other healthy, shade-intolerant dominant and codominant trees. Live trees with broken boles, large down woody material, and dead standing trees that do not qualify as hazards under OSHA regulations would be reserved.

2. Slash disposal and site preparation for regeneration

Logging slash would be hand-lopped and scattered. Site preparation would not be required because structural enhancement is not a regeneration treatment.

3. Regeneration

This treatment would not promote regeneration. Structural enhancement would reduce competition from encroaching shade-tolerant species and extend the presence of large, shade-intolerant trees, thereby maintaining species diversity.

IV. SUMMARY OF ENVIRONMENTAL EFFECTS

The following table summarizes the environmental consequences of the alternatives. The scientific basis for the environmental effects summarized here is discussed in more detail in Chapter 4. Refer to Chapter 4 for a complete understanding of the terms, quantities, and statements presented here.

TABLE 2.1 SUMMARY OF ENVIRONMENTAL EFFECTS

RESOURCE	ALTERNATIVES			
	A	B	C	D
Forest Conditions				
1. Cover Type Representation	Continued shift to shade-tolerant species	Increase shade-intolerant species by 222 acres*	Increase shade-intolerant species by 405 acres	Increase shade-intolerant species by 411 acres
2. Age Class Distribution and Old Stands in Project Area	Overall increase in old stands over time	Old stands reduced by 76 acres	Old stands reduced by 74 acres	Old stands reduced by 135 acres
3. Replacement Old Stands in Western larch / Douglas-fir type	No development of replacement old stands	No development of replacement old stands	Increase of 8 %	Increase of 7%
4. Stand Vigor	Shade-intolerant species crowed out; reduction in vigor	468 acres raised to full vigor; 209 acres raised one vigor class*	577 acres raised to full vigor	302 acres raised to full vigor; 355 acres raised one vigor class; no change in 48 acres
5. Patch Sizes by Cover Type	Increased patch size over time	Decrease in patch sizes in white pine, subalpine fir and mixed conifer types; increase in patch size in western larch/ Douglas-fir and Douglas-fir types	Decrease in patch size in white pine, Douglas-fir, subalpine fire and mixed conifer types; increase in patch sizes on western larch/Douglas-fir types	Decrease in patch size on white pine, western larch/Douglas-fir, subalpine fir and mixed conifer types.
6. Patch Sizes by Age Class in the project area	Increase in patch size by age class over time	41-acre decrease in average patch size in old stands	109-acre decrease in average patch size in old stands	47-acre decrease in average patch size in old stands
7. Patch Shape by Cover Type	Reduction in complexity of patch shape**	Reduction in complexity of patch shape	Reduction in complexity of patch shape	Reduction in complexity of patch shape
8. Patch Shape by Age Class	Decrease in patch shape	Increase in complexity of old stand patches	No effects on patch shape	Substantial Decrease in patch shape complexity
Grizzly Bear				
1. Open Roads (% entire subunit >1.0 mi/mi ^{2})	28%	28%	28%	28%

TABLE 2.1 SUMMARY OF ENVIRONMENTAL EFFECTS

RESOURCE	ALTERNATIVES			
	A	B	C	D
2. Open Roads (% DNRC acres >1.0 mi/mi^2)	34%	34%	34%	34%
3. Total Roads (% entire subunit >2.0 mi/mi^2)	45%	47%	47%	47%
4. Total Roads (% DNRC acres >2.0 mi/mi^2)	54%	56%	56%	55%
5. Core Area (entire subunit)	45%	36%	36%	37%
6. Core Area (DNRC acres)	28%	25%	24%	27%
7. Hiding Cover (entire subunit)	79%	77%	77%	89%
8. Hiding Cover (DNRC acres)	91%	88%	24%	89%
Elk				
1. Habitat Effectiveness	71%	54%	51%	53%
2. Thermal Cover (% of winter range, *(remaining after harvest?)* DNRC acres)	23%	19%	23%	19%
3. Elk Security Cover (DNRC acres)	45%	10%	10%	10

TABLE 2.1 SUMMARY OF ENVIRONMENTAL EFFECTS

RESOURCE	ALTERNATIVES			
	A	B	C	D
Aesthetics* **				
1. General landscape characteristics (Variety = landscapes which are object-rich; contrast = the degree to which objects are distinguished from one another; texture = distinctive or identifying feature of the landscape depending on distance)	Change would continue due to natural processes. Character of landscape would remain the same.	Wild, rugged character would remain the same. Light and moderate-reserve treatments would increase variety and contrast. Heavy-reserve treatment would change texture, with subtle changes to variety and contrast.	Wild, rugged character would remain the same. Light and moderate-reserve treatments would increase variety and contrast. Heavy-reserve treatment would change texture, with subtle changes to variety and contrast.	Wild, rugged character would remain the same. Light and moderate-reserve treatments would increase variety and contrast. Heavy-reserve treatment would change texture with subtle changes to variety. Structural enhancement treatment would result in subtle changes to texture
Water Quality				
1. Annual runoff South Fork Lost Creek Watershed	1% increase over natural runoff. (10% allowable increase)	3% increase over natural runoff. (10% allowable increase)	3% increase over natural runoff. (10% allowable increase)	2% increase over natural runoff. (10 % allowable increase)
2. Number of cutting units located within a SMZ.	None	None	None	None
3. Existing Sources of Sediment that would be mitigated.	Erosion sources not mitigated.	10.3 miles of road brought up to current BMPs, relocation of 1.7 miles of road currently located in SMZ, replacement of Cliff Creek bridge, rehabilitation of 2 bridges on S. Fork Lost Creek.	10.3 miles of road brought up to current BMPs, relocation of 1.7 miles of road currently located in SMZ, replacement of Cliff Creek bridge, rehabilitation of 2 bridges on S. Fork Lost Creek.	10.3 miles of road brought up to current BMPs, relocation of 1.7 miles of road currently located in SMZ, replacement of Cliff Creek bridge, rehabilitation of 2 bridges on S. Fork Lost Creek.

TABLE 2.1 SUMMARY OF ENVIRONMENTAL EFFECTS

RESOURCE	ALTERNATIVES			
	A	B	C	D
Fisheries				
1. Impacts to fisheries habitat	No change to fisheries from current condition. No additional habitat monitoring.	Low potential risk to fisheries habitat or populations. Continue to monitor fish habitat for at least one year after project completion.	Low potential risk to fisheries habitat or populations. Continue to monitor fish habitat for at least one year after project completion.	Low potential risk to fisheries habitat or populations. Continue to monitor fish habitat for at least one year after project completion.
Air Quality				
	No change to existing air quality.	Burning on 626 acres: Temporary reduction in air quality.	Burning on 668 acres: Temporary reduction in air quality.	Burning on 695 acres: Temporary reduction in air quality.
Soils				
1. Soil Erosion Potential from Road System	Erosion potential may increase on existing road system.	Decrease erosion potential by implementing mitigation.	Decrease erosion potential by implementing mitigation.	Decrease erosion potential by implementing mitigation.
2. Soil Impacts: Displacement and Compaction	No change in existing compaction of the area in old skid trails and landings.	Mitigation would limit impacts to about 8% of the harvested acres. Approximately 48 acres would be affected	Mitigation would limit impacts to about 6% of the harvested acres. Approximately 39 acres would be affected	Mitigation would limit impacts to about 11% of the harvested acres. Approximately 72 acres would be affected
Sensitive Species				
1. Black-backed Woodpeckers	Probability of creation of habitat would remain stable or increase with time, and acreage of potential future habitat would not change	Reduction in probability of creation of habitat, and reduction in acreage of potential future habitat by 508 acres	Reduction in probability of creation of habitat, and reduction in acreage of potential future habitat by 458 acres	Reduction in probability of creation of habitat, and reduction in acreage of potential future habitat by 305 acres

TABLE 2.1 SUMMARY OF ENVIRONMENTAL EFFECTS

RESOURCE	ALTERNATIVES			
	A	B	C	D
2. Western Big-eared Bat	No change in communal or individual roost site availability	No change in communal roost site availability. Some decrease in availability of individual roost sites	No change in communal roost site availability. Some decrease in availability of individual roost sites	No change in communal roost site availability. Some decrease in availability of individual roost sites
3. Boreal Owls	No harvest would be done in the 247 acres of boreal owl habitat in the project area	46 acres (19%) of the boreal owl habitat in the project area would be harvested	No harvest would be done in the 247 acres of boreal owl habitat in the project area	113 acres (46%) of the boreal owl habitat in the project area would be harvested
4. Fisher	No harvest would be done in preferred fisher riparian habitat. Trapper access into preferred habitat would remain high. Travel cover would remain available over most of the project area.	No harvest would take place in preferred riparian habitat. Trapper access into preferred habitat would decrease. Travel cover would be reduced for next 20-40 years on 54 acres.	No harvest would take place in preferred riparian habitat. Trapper access into preferred habitat would decrease. Travel cover would be reduced for next 20-40 years on 11 acres.	No harvest would take place in preferred riparian habitat. Trapper access into preferred habitat would decrease. Travel cover would be reduced for next 20-40 years on 11 acres and for next 15-20 years on 260 acres.

TABLE 2.1 SUMMARY OF ENVIRONMENTAL EFFECTS

RESOURCE	ALTERNATIVES			
	A	B	C	D
5. Lynx	No changes in availability of foraging habitat, trapper access, or travel cover. Availability of denning habitat probably would remain stable, and quality might increase over time.	Foraging habitat availability probably would increase on 339 acres. Cover for travel would decrease for 10-20 years on these same 339 acres. Trapper access probably would not change. 46 acres of potential denning habitat would be harvested.	Foraging habitat availability probably would increase on 191 acres. Cover for travel would decrease for 10-20 years on these same 191 acres. Trapper access probably would not change. Availability of denning habitat should remain stable, and quality might increase over time.	Foraging habitat availability probably would increase on 241 acres. Cover for travel would decrease for 10-20 years on these same 241 acres. Trapper access probably would not change. 113 acres of potential denning habitat would be harvested.
6. Pileated Woodpeckers	No harvest would take place in nesting or foraging habitat.	No harvest would take place in nesting habitat. Quality of foraging habitat would greatly decrease on 79 acres.	No harvest would take place in nesting habitat. Quality of foraging habitat would greatly decrease on 11 acres.	Structural enhancement harvest in nesting habitat may improve habitat in the long run if skid trails do not increase access for firewood cutters. Quality of foraging habitat would decrease somewhat on 260 acres.

*Indications of increased acreage refer to conditions after harvest and regeneration, either natural or by planting, or both.

**Numbers indicating patch shape refer to an index developed by McGarigal and Marks (1994). The lowest number, 1, refers to a perfectly square patch.

***As noted in the text, harvest units generally will be out of view of the public, or visible only at a distance.

CHAPTER 3

AFFECTED ENVIRONMENT

Environmental Characteristics, Analysis Areas, and Analysis Methods

This chapter contains information on the environment in the Swan valley, the Swan River State Forest (SRSF), and the project area. The size of the analysis areas varies among resources depending on the requirements of the resource being analyzed and the methods used for the analysis. The cumulative effects of past activities are discussed in this chapter in terms of current conditions of resources.



Photo 2- Rocky cliffs in South Fork Lost Creek area.

I. PROJECT AREA

The project area comprises approximately 4,306 acres in the watershed of the South Fork of Lost Creek. Topography consists mainly of a steep narrow canyon with riparian areas along the streams, rocky outcrops and cliffs, avalanche chutes, heavily-timbered slopes and subalpine terrain. Elevations range from approximately 3,360 feet to 7,238 feet.

The project area is bordered on the north and south by high steep ridges that provide natural boundaries. These ridges run generally east-west, with their eastern ends in the alpine terrain at the eastern border of the watershed. The western border of the project area extends between the west ends of the ridges where the South Fork Lost Creek leaves the canyon between them and flows out onto the valley floor. The east border consists of the eastern boundary of the SRSF.

II. FOREST CONDITIONS

A. BACKGROUND

1. Landscape Analysis

The SFLMP directs DNRC to "take a coarse filter approach to biodiversity by favoring an appropriate mix of stand structures and compositions on state lands" (Montana DNRC 1996). To implement a coarse filter approach and to meet SFLMP directives, landscape analysis techniques were used to determine an appropriate mix of stand structures and compositions including cover type representation, age class distribution, structural characteristics, and spatial considerations such as patch size, shape and location.

Landscape assessment and analysis is by its nature a hierarchical process (Turner *et al.* 1993). Different components of the landscape exist and interact at different scales. Relationships among landscape components also exist across varying scales.

SFLMP calls for a landscape analysis to be completed at the project level. Some components of landscape analysis are examined at a broader scale. Examples include historical forest conditions and various spatial characteristics of the landscape. At the very broad scaled, federal agencies have recently published a draft EIS for the Interior Columbia River Basin Project (ICRBEMP 1997). Information from the draft EIS can be used to describe how small-scale project analyses, such as that for the South Fork of Lost Creek proposed project, fit into the regional picture of ecosystem condition.

In the following analysis, forest characteristics are examined at six scales: the stand, the South Fork of Lost Creek project area, The Swan River State Forest, The Climatic Section, western Montana, and the Interior Columbia River Basin (ICRB). The data are used to determine both historical conditions and project effects on forest characteristics in general and on old forests in particular.

2. Old Growth Commitments from SFLMP

The SFLMP states that DNRC would "seek to maintain or restore old growth forest in amounts of at least half the average proportion that would be expected to occur with natural processes on similar sites" (DNRC 1996). Old growth not only must be retained in the amount agreed to, but also in appropriate proportions and in appropriate sites across the landscape. This makes it important to define the proportions of particular forest types that would be expected to develop within particular landscapes, rather than the much easier but ecologically unsustainable approach of managing simply for what is there now.

When defining old growth minimums for state forested lands, several complications must be addressed. An old growth definition acceptable to all, or even most, resource professionals does not exist. The components important in one type of old growth may not be present or important in another type, thus a definition of old growth for one forest type would not necessarily be applicable to another forest type. An arbitrary cut-off point between being or not being old growth is not biologically nor logically defensible; the characteristics of old growth stands that make them functionally different than other stands should be defined and managed for, rather than arbitrarily deciding one stand is old growth while another is not. Finally, the biggest obstacle related to quantifying the SFLMP's "at least half" minimum is that no quantification of historic old growth amounts exists and there is no realistic possibility of one ever being developed.

There are, however, estimates of historic age class distributions and accompanying estimates of proportions of old stands. Thus, to ensure meeting SFLMP commitments, it is necessary to use 'old stands' as a surrogate for old growth. Although DNRC must manage for and assess the SFLMP commitment based on old stands, that is not to say the notion of 'old growth' would be ignored. Characteristics of stands that are generally associated with the popular term 'old growth' need to be assessed. Old stands that have 'old growth' characteristics and stands that do not should both be included in DNRC's retention of old stands.

Historically, both types of stands were represented among old stands. Because the SFLMP commits to the management of old growth in one half the amount that existed historically, and nature did not always provide 'old growthedness' in old stands, a balanced approach is required in maintenance of the two types of stands.

A key assumption is that retaining one half of old stands would retain more old stands than if one half of old growth were retained (i.e., the age class distribution would show a higher proportion of old stands than if only those labeled as old growth were retained). A corollary assumption is that both types of old stands (i.e., old but not decadent, and old and decadent) are necessary to develop and retain the various characteristics of stands that may be important, but undefined.

Consequently, stands should be assessed as they come up for treatment on a project by project basis, keeping some with high 'old growthedness' qualities while possibly harvesting others. Additionally, stands that are not technically old may possess many important 'old growth' components serving old growth function better than some actual old stands, and thus should be considered as potential replacement old stands.

The intent of the SFLMP is to maintain enough old growth to meet the specified old growth commitment, but to not drop below that amount. The 'at least half' amount represents the minimum DNRC has committed to retaining, but does not necessarily represent the maximum desirable for retention.

B. REGIONAL ASSESSMENT

1. INTERIOR COLUMBIA RIVER BASIN

At the broad scale, assessments prepared for the 1997 ICRB draft EIS (ICRBEMP 1997) are useful in examining how DNRC's small corner of the larger ecosystem fits into the bigger picture. The ICRB EIS reports on current ecosystem integrity and changes since the arrival of European-Americans. The effects of DNRC's activities at the project level would be negligible at the Basin scale. However, over time, human activities, such as fire suppression, timber harvesting, building roads and cities, have had cumulative effects on the condition of the forests across the entire basin.

Project actions must be considered within the broad scale and acknowledge that there may be positive or negative effects on broad scale conditions while still meeting DNRC's goals and objectives. DNRC's mandate is to generate revenue; the SFLMP clearly states the goal of managing for biodiversity and forest health on state forested trust lands, but not to make up for inappropriate conditions created by others on other ownerships (ROD 1996).

The information is useful for describing how state forests and project areas fit into the larger scheme of landscape condition. General trends in forests across the Interior Columbia River Basin show a decrease of ponderosa pine, western larch and western white pine across their ranges. Primary transitions were to the more shade-tolerant species (true firs, hemlocks, spruces, and western red cedar). Fire regimes have increased in severity from predominantly mixed and lethal severities to a large predominance of lethal severity. Acres of old forests of both multi-story and single-story structure also have decreased.

The ICRB grouped forests into three broad categories--dry, moist, and cold. The dry category includes ponderosa pine, dry Douglas-fir, and dry grand fir forests. The moist group includes cedar/hemlock, moist Douglas-fir, grand fir, and wet spruce-fir forests; the cold group includes the higher elevation forests not falling into one of the other two categories. Most of the SRSF falls into the moist group with some in the cold, and very little in the dry forest group.

All three forest groups have experienced large increases in dominance by shade-tolerant species due to timber harvesting, fire suppression, insects and disease. Further, all three groups are much more likely to experience stand replacement fires currently than historically. Increased density and canopy layering result in hotter burns with a greater likelihood of killing large overstory dominants and destroying duff layers and shallow roots of species that generally would survive fire disturbance under more natural conditions.

An overall decrease in old stands has occurred in the dry forest group concomitant to a large increase in the multi-storied condition and a large decrease in single storied forests. Within the multi-story forests, shade-tolerant tree species are three times as abundant. Ponderosa pine has been replaced by grand fir or Douglas-fir on nearly 40 percent of its range. Currently, shade-tolerant species dominate 30 percent more stands than historically. There also are 25 percent more acres of young stands. This dry forest group represents less than 5 percent of the SRSF.

The moist forest group also has seen a large increase in density, and dominance by shade-tolerant species. It has experienced decreases in early seral and old stands. Old forests of shade-intolerant species (primarily ponderosal pine,western larch, and in places, Douglas-fir) have decreased 86 percent while old forest dominated by shade-tolerant species has doubled. Both shade-intolerant and shade-tolerant species multi-story forests have decreased. Young forests of shade-tolerants are far denser and are twice as common. Young forests of shade-intolerants are 33 percent less common than historically. Over 85 percent of the SRSF falls into the moist forest group.

Cold forests have experienced less change due to elevation and slow growth. However, here too shade-tolerants (e.g., spruce, and subalpine fir) have increased at the expense of shade-intolerants, primarily whitebark pine and alpine larch. About 10 percent of the SRSF falls into the cold forest group.

C. HISTORICAL FOREST CONDITIONS

Estimating historical conditions is important in defining what the forest looked like before widespread influences of the industrial age. The working assumption is that average historical conditions represent a healthy, sustainable, biodiverse forest with all the pieces intact, that is an appropriate forest condition as commited to in the SFLMP. Historical conditions provide an indication of a desirable future condition for the forest, tempered necessarily, by current circumstances.

None of the many ways of characterizing historical forests is completely satisfactory. Direct observations over a long period of time would provide a fairly clear picture of a historical range of variability, but these are not available. Actual observation of known historical conditions made over wide areas can provide a similarly clear picture by, in effect, substituting space for time. The 'space for time' concept relies on observations over a broad enough area to encompass and average the variety of natural disturbances

and allow an assessment of trends in vegetation as they are affected by broad scale climatic factors and disturbance regimes. Such an assessment provides an indication of average conditions similar to what might be obtained from a series of historical observations from different times. As the scale is reduced, the impacts of single disturbance events can unduly influence the forest conditions making interpretation of average historical conditions difficult and prone to errors. Only by assessing average historical conditions along with current conditions and project effects can there be a determination of the developmental trajectory of the forest and the actions necessary to move toward historical conditions.

1. Data Sources

At progressively smaller scales than the ICRB (e.g., western Montana, and the general climatic section) the best inventory information available to approximate pre-industrial age forest conditions was prepared by Losensky (1997). Losensky summarizes a 1930 inventory completed for all forest lands in western Montana and his data are ideal for the substitution of the 'space for time' concept. The data that Losensky used for broader assessments include the original inventory of the Swan valley.

The 1930s inventory that Losensky summarized has been digitized at the scale of the SRSF and the South Lost project area and the data are carried as a layer in DNRC's Geographic Information System (GIS).

Other recent assessments of historic forest conditions in the general area of the SRSF have been made by the Flathead National Forest (USFS 1992), Hart (1994), and the analysis conducted by DNRC for the Middle Soup EIS (DNRC 1997) which also summarizes the other works mentioned above.

2. Cover Type Representation

The first step in determining historical forest conditions is to quantify historical cover type proportions on the landscape. Losensky (1997) provides historical amounts of cover types (including species composition relative to proportion of stand board foot volume), corresponding age class distribution (determined from the same species and size class used for cover type), and proportion of old stands by cover type. The cover type age class data provide an essential component for determining average historical conditions.

The historical data for proportions of cover types in all of western Montana, Climatic Section 333C, the SRSF, and the South Fork Lost Creek project area are summarized in Table 3-1. The Climatic Section is contained in western Montana and includes the entire Swan River State Forest. The Climatic Section (or the upper Flathead Valley) corresponds to the area between Flathead Lake and the Continental Divide and from the Canadian Boundary south to the Clearwater River - Swan River divide.

The data indicate that Climatic Section 333C is cooler and moister than is average for western Montana with higher proportions of lodgepole pine, mixed conifers, and subalpine types. The lower proportions of ponderosa pine and Douglas-fir also indicate a cooler and moister environment. Both western Montana and the Climatic Section are big enough to represent general trends and average conditions whereas the 39,000-acre SRSF is too small. Data from SRSF and the South Fork Lost Creek project area are useful for examining trends in vegetative change brought about through succes-

TABLE 3-1. THE HISTORICAL PROPORTION OF EACH COVER TYPE IN WESTERN MONTANA, CLIMATIC SECTION 333C (THE UPPER FLATHEAD VALLEY), SWAN RIVER STATE FOREST, AND THE PROJECT AREA.

Cover Type	Proportional Representation (%)*			
	Western Montana	Upper Flathead	Swan Forest	South Lost
Ponderosa Pine	21	1	3	2
Douglas-fir	8	less than 1	0	5
Western larch / Douglas-fir	26	28	68	38
White pine	3	1	8	0
Lodgepole pine	20	27	5	0
Mixed conifer	3	6	9	27
Subalpine types	20	36	2	26
Other types	trace	trace	5	2

*Estimated from 1930s inventory data. The proportion of area is based on all forested lands; water and non-forest were not included. The western Montana and upper Flathead numbers were summarized by Losensky (1997). SRSF and South Fork Lost Creek numbers are from DNRC analysis of 1930s data.

sion, fire suppression, harvesting and other activities, but the small size of these areas prevents their use in determining average conditions.

Table 3-1 shows that historic representation of shade-intolerant tree species (e.g., ponderosa pine, western larch, white pine, lodgepole pine and Douglas-fir) cover types averaged 67 percent for western Montana, 56 percent for the climatic section average, and 79 percent for SRSF. The South Fork Lost Creek project area, however, was dominated by shade-tolerant tree cover types (e.g., mixed conifer, subalpine fir) at 53 percent. Western larch/Douglas-fir dominated SRSF and to a lesser extent the South Fork Lost Creek project area. All of the Douglas-fir cover types were represented in the South Fork Lost Creek area. The South Fork Lost Creek area contained 49 percent of the subalpine types on SRSF and 30 percent of the mixed conifer types.

3. AGE CLASS DISTRIBUTIONS

Age class distributions delineate another characteristic important for determining average historical or appropriate conditions. When these distributions are combined with information on cover types, a fairly clear picture emerges of what average forest conditions were over time. Knowledge about local topographic effects, ecological characteristics of tree species, climatic-vegetational relationships, and disturbance regimes adds clarity to the picture of probable historical conditions. However, these other characteristics are largely static over time, so historical quantifications are not as necessary as it is for cover type representations and age class distributions.

The 1930s inventories also quantified the ages of forest stands. Losensky examined the data and projected the stands back in time to the early 1900s to arrive at age estimates. These data are useful in setting baseline conditions for determining the extent to which current forest age class distributions deviate from average historical

TABLE 3-2. HISTORICAL AGE CLASS STRUCTURE BY COVER TYPE FOR ALL OF WESTERN MONTANA. PROPORTIONS (%) ARE BASED ON ACRES WITHIN EACH COVER TYPE.

Cover Type[1]	Non-stocked	1-40 years	41-100 years	101 yrs - Old Stands	Old Stands[2]
Ponderosa Pine	8%	10	11	16	55
Douglas-fir	5	23	33	34	7
Western larch / Douglas-fir	18	19	13	19	31
White pine	23	23	11	22	21
Lodgepole pine	18	39	31	9	3
Mixed conifer	6	11	19	20	43
AVERAGE[3]	15%	24%	20%	18%	23%

[1] The subalpine type ages were not summarized in Losenky's report because they were inconsistently reported; some areas had them, others did not.
[2] Stands were considered old if they were over 170 years for ponderosa pine, Douglas-fir, and western larch/Douglas fir, 180 years for white pine and mixed conifer, and 140 years for lodgepole pine.
[3] The average represents the average age-class structure across all cover types. Non-forest land is not included.

conditions. Old stands from the 1930s data were described as those stands over 170 years of age for ponderosa pine, Douglas-fir, and western larch cover types, over 140 years for lodgepole pine, and over 180 years for the other types. No qualities other than stand age went into the assessments of historical old stand proportions. Old growth would make up a portion of all old stands, but not all old stands would contain old growth qualities other than age (see discussion above Old Growth Commitments from the SFLMP).

TABLE 3-3. HISTORICAL AGE CLASS STRUCTURE FOR EACH COVER TYPE IN CLIMATIC SECTION 333C (UPPER FLATHEAD VALLEY). NON-FOREST LAND IS NOT INCLUDED.

Cover Type[1]	Non-stocked	1-40 years	41-100 years	101 yrs - Old Stands	Old Stands[2]
Ponderosa Pine	2%	11	6	7	74
Douglas-fir	2	24	39	29	6
Western larch / Douglas-fir	10	13	10	20	47
White pine	0	1	28	54	17
Lodgepole pine	21	38	29	7	5
Mixed conifer	2	4	9	42	43
AVERAGE	14	22	13	22	29

[1] The subalpine type was not assigned an age in the 1930s inventory.
[2] Stands were condidered old if they were over 170 years for ponderosa pine, Douglas-fir, and western larch/Douglas-fir, 180 years for white pine and mixed conifer, and 140 years for lodgepole pine.

Tables 3-2 through 3-5 show the historic age class structure by cover type for western Montana, the Climatic Section, the SRSF, and the South Fork Lost Creek project area. Overall, the data in Tables 3-2 and 3-3 show the decreasing proportions in successively older age classes typical of broad scale assessments. Anomalies do occur within a cover type, such as the white pine type for the Climatic Section, where data show only 1 percent of the acres are in the non-stocked to 40-year age class, while 28 percent are in the next older age class. These anomalies are due primarily to small sample size. Mostly though, the proportions fall within expected ranges given known disturbance regimes, competitive abilities of various species, and ecological requirements.
The proportions of mature and old stands in the Tables 3-2 and 3-3 indicate the cooler and moister conditions of the Cimatic Section compared to all of western Montana. Development of this older age class structure suggests that fire frequency at the climatic section level is slightly longer and that many fires of less than stand replacement severity occurred allowing stands to maintain vertical structure and older trees after fires, although at considerably lower stocking or density. Additionally, the general effects of succession are shown in the low proportions of younger age classes of shade-tolerant tree species.

Historical data compiled for theSRSF from the 1930s inventory are shown in Table 3-4, with Table 3-5 showing data from the same source for the South Fork Lost Creek project area. These tables show the irregular age class distributions typical of smaller scale assessments. Such distributions reflect an area heavily influenced by individual disturbance events (for the lodgepole type), or the lack of disturbance (for the other types).

Comparing Tables 3-2 and 3-3 to Table 3-4 shows that in the 1930s the SRSF was more heavily weighted to older age classes than would be expected with long term average conditions. The data show the proportion of old stands as 2.5 times that contained in

TABLE 3-4. 1930S INVENTORY DATA FOR PROPORTIONAL AGE CLASS STRUCTURE BY COVER TYPE FOR THE SRSF. THE AVERAGE REPRESENTS THE AVERAGE AGE CLASS STRUCTURE ACROSS ALL COVER TYPES.

Cover Type[1]	Non-stocked	0-39 years	40-99 years	100 yrs - Old Stands	Old Stands[2]
Ponderosa Pine		0%	0	0	100
Douglas-fir		0	0	0	0
Western larch / Douglas-fir		4	7	8	81
White pine		0	0	0	100
Lodgepole pine		36	74	0	0
Mixed conifer		0	7	24	69
Subalpine types		0	11	13	76
TOTAL	5	4	9	8	74

[1] The non-stocked category represents land that was not typed in the 1930s inventory.
[2] Stands were considered old if they were over 170 years for ponderosa pine, Douglas-fir, and western larch/Douglas-fir, 180 years for white pine, subalpine and mixed conifer, and 140 years for lodgepole pine.

the entire Climatic Section and over three times the proportion for all of western Montana. Correspondingly, younger age classes were substantially under represented. In particular the under-40 and non-stocked categories totaled 9 percent of the SRSF in 1930, constrasted to 36 percent of the Climatic Section. The data suggest the SRSF has avoided signficant disturbance for many years due to the random nature of disturbance, rather than any unique topographic, climatic, or physiological conditions (see discussions on habitat type groups and fire regimes).

The 1930s inventory of the SRSF shows a forest that has been relatively free from disturbance for a considerable time. SRSF's 74 percent in old stands contrasts to broader scale quantifications made by several other researchers. Losensky's (1997) data for the broader Climatic Section showed only 29 percent old stands. The Flathead National Forest (USFS 1992) concluded that at the turn of the century, in the Swan valley, "About 40 percent of the area was occupied by mature and older forests." Lesica (1996) suggested through mathematical modeling that 34.5 percent of forests with a mean fire return interval of 150 years (roughly equivalent to much of the Swan valley) would be in age classes of 160 years and older.

Table 3-5 shows the 1930s inventory age class and cover type distributions within the South Fork Lost Creek project. The non-stocked acres number in the subalpine cover type refers to non-commercial acres, as so deemed in the 1930s. These are not included in the overall proportions of the various age classes. An older forest is present in the South Fork Lost Creek area than in the SRSF in general with a much higher proportion of shade-tolerant species cover types. The type and age characteristics reflect the long absence of disturbance and the effects of forest succession.

TABLE 3-5. 1930S DATA FOR PROPORTIONAL AGE CLASS DISTRIBUTION BY COVER TYPE AND ACRES OF COVER TYPE WITHIN THE SOUTH FORK LOST CREEK PROJECT AREA. THE AVERAGE REPRESENTS THE AVERAGE AGE CLASS STRUCTURE ACROSS ALL COVER TYPES.

Cover Type	Non-stocked	1-39 years	40-99 years	100 yrs - Old Stands	Old Stands
Ponderosa Pine	0%	0	0	0	100
Douglas-fir	0	0	0	0	0
Western larch/Douglas-fir	2	10	11	0	77
White pine	0	0	0	0	100
Lodgepole pine	0	80	20	0	0
Mixed conifer	0	0	0	less than [1]	99
Subalpine types	76[1]	0	0	less than [1]	99
TOTAL[2]	27[1]	6[3]	6[3]	less than [3]	88

[1] The non-stocked category represents land that was not categorized by type or age in the 1930s inventory. The non-stocked numbers in the subalpine cover type refer to non-commercial land (as deemed in the 1930s), which was not categorized by age. Non-commercial land is not included in the overall proportions of the various age classes.

[2] Water, hardwoods, and non-forest categories have been removed.

[3] Percentages are based only on those acres that were assigned an age. Non-stocked and non-commercial land that was not assigned an age is not represented in the table.

4. Habitat type Groups

Habitat type groups define areas of similar temperature and moisture regimes capable of supporting particular vegetative associations. Representation of habitat type groups (HTG) for the entire SRSF and the South Fork Lost Creek project area is shown in Table 3-6. As the table shows, the SRSF is slightly warmer than the South Fork Lost Creek project area with higher representation of warm habitat type groups and lower proportional representation of cool habitat type groups. The differences are not substantial with both areas being dominated by moist groups and in particular the warm moist group. Thus, conditions at the broader scale of the SRSF should not differ greatly from those in the South Fork Lost Creek project area. However, Tables 3-4 and 3-5 show the older ages and more shade-tolerant tree cover reflecting the lack of disturbance. The HTG information shows that differences in growing conditions between the SRSF and the South Fork Lost Creek project area are not sufficient to explain the differences in age and cover type. Consequently, frequency of disturbance can be viewed as the cause for the discrepancy.

66 percent of the SRSF is in the warm moist HTG. Fully 74 percent of historic western larch / Douglas-fir types occurred on the warm/moist HTG. Additionally, the western larch / Douglas-fir cover type made up 76 percent of the warm/moist HTG, 65 percent of the moderately warm/dry HTG, and 42 percent of the cool and moist HTG. No other cover type formed a plurality on any of the HTG's. Historically, the mixed conifer type represented only 4 percent of the warm/moist HTG.

Table 3-6. Habitat type group representation on SRSF and the South Lost project area.*

Habitat Type Group	Acres		Proportion of Area (%)	
	SRSF	South Fork Lost Creek	SRSF	South Fork Lost Creek
Moderately warm/dry	1900	0	5	less than 1
Moderately cool/dry	218	0	1	less than 1
Warm and moist	25,474	2,414	66	56
Cool and moist	9,328	1,778	24	41
Wet	826	98	2	2
Moderately cool/moist	120	0	less than 1	less than 1
Cool and moderately dry	639	0	2	less than 1
Cold and moderately dry	56	14	less than 1	less than 1

*Habitat type grouping follows Green *et al.* 1993.

5. Structural Characteristics

Historical structural characteristics are not defined beyond the same classes used to describe age class distributions. The structural categories defined for the various age classes are as follows: ages 1 to 40 - seedling to sapling; 41 to 100 - poles; 101 to old stands - mature; and 170 or 180 and over - old stands. These categories may or may not be meaningful due to the strict adherence to stand age used for their assignment.

TABLE 3-7. PATCH SIZE AND SHAPE INDEX BY COVER TYPE FROM THE 1930S INVENTORY ON THE SRSF AND THE SOUTH FORK LOST CREEK PROJECT AREA. PATCH SIZE IS EXPRESSED IN ACRES FOR PATCHES OF EQUIVALENT COVER TYPE. PATCH SHAPE WAS DERIVED WITH THE PATCH SHAPE INDEX OF MCGARIGAL AND MARKS (1994)*.

Cover Type	Average Patch Size (acres)		Patch Shape Index	
	SRSF	South Fork Lost Creek	SRSF	South Fork Lost Creek
Ponderosa Pine	147	85	1.34	1.11
Douglas-fir	113	113	1.35	1.40
Western larch / Douglas-fir	820	791	1.33	1.91
White pine	196	12	1.38	1.60
Lodgepole pine	94	6	1.33	1.48
Mixed conifer	123	556	1.33	1.69
Subalpine types	204	365	1.53	1.60
Water	36	29	2.45	1.53
Non-forest	37	245	1.20	1.99
AVERAGE	248	260	1.38	1.60

*The patch shape index of McGarigal and Marks (1994) calculates patch shape complexity. The calculation uses the perimeter and area of each patch, and corrects for the effects of patch size. A perfectly square patch takes a value of 1. Circular patches have a complexity value less than 1. More irregular shapes take numbers higher than 1.

6. PATCH CHARACTERISTICS

The SRSF and the project area are the only scales analyzed for which historic quantification of patch size and shape information is available. 1930s patch size and patch shape indices by cover type are shown in Table 3-7. The western larch / Douglas-fir patch size quantification is dominated by a single patch over 7,000 acres, much of which occurred within the South Lost project area.

Historic patch sizes and shapes for different age classes are shown in Table 3-8. Note the large patch sizes of old stands, particularly within the project area. Overall, age class patch sizes do not differ greatly from cover type patch sizes. Patch shape is simpler for the SRSF than the project area, but rather than pointing out complexities it reflects the differences in scale. Patch shape information is useful in comparing patches within the same landscape over time.

7. FOREST FIRE HISTORY IN THE SWAN VALLEY

Fire has been a major influence on the characteristics of forested landscapes in the Swan valley, as in most forests of western Montana. The severity, frequency, and area covered by fires varies, depending on micro-site conditions, from infrequent, stand-replacing burns, through intermediate frequency, intermediate intensity burns, to frequent, thinning underburns. The latter type appears to have been restricted to the upper portion of the Swan River drainage, south of the SRSF.

TABLE 3-8. PATCH SIZE AND SHAPE INDEX BY AGE CLASS FROM THE 1930S INVENTORY ON THE SRSF. PATCH SIZE IS EXPRESSED IN ACRES FOR PATCHES OF EQUIVALENT AGE. PATCH SHAPE DERIVED FROM THE PATCH SHAPE INDEX OF MCGARIGAL AND MARKS (1994)*.

Age Class	Average Patch Size (acres)		Patch Shape Index	
	SRSF	South Fork Lost Creek	SRSF	South Fork Lost Creek
Non-stocked	93	222	1.45	1.63
1 - 40	85	42	1.42	1.43
41 - 100	202	35	1.34	1.46
101 - Old Stands	90	15	1.42	1.55
Old Stands	696	1,339	1.46	1.59
AVERAGE	300	245	1.42	1.52

*The patch shape index of McGarigal and Marks (1994) calculates patch shape complexity. The calculation uses the perimeter and area of each patch, and corrects for the effects of patch size. A perfectly square patch takes a value of 1. Circular patches have a complexity value less than 1. More irregular shapes take numbers higher than 1.

Hart (1994:36) summarized the historical data as follows:

> Although most of the burns...were of stand-replacement intensity, many less intense fires had also crept over wide areas. The upper [i.e., southern] half of the Swan valley had been extensively burned, and was blanketed by fallen trees. In this area, fires were moderate, thinning the forest. The lower [i.e., northern] Swan also was scarred by fires, but it had a great deal of older mixed forest; species typical of mesic sites were found in this region....

Antos and Habeck (1981), working mostly in the northern portion of the Swan valley, emphasized the dominance of low-frequency, high-intensity fires (i.e., "stand-replacement fires") in determining stand patterns:

> During most summers, the occurrence of frequent rain makes intense fires unlikely; but in some years, dry summers set the stage for large crown fires. Most stands were initiated on large burns.... An average frequency of replacement burns of between 100 and 200 years was characteristic.... Stands over 300 years old do occur, and repeat burns less than 20 years apart have also occurred. In some forests initiated by replacement burns, ground fires have occurred after stand establishment, with variable effects on the over story. Very wet sites such as stream bottoms and lower north slopes often experience partial burns when located within the perimeter of large replacement burns" (Antos and Habeck 1981:29).

Freedman and Habeck (1984), who worked primarily in drier forests south of the South Lost project area but as far north as Goat Creek in the SRSF, emphasized the role of more frequent burns in the southern portion of the Swan valley, while agreeing with Antos and Habeck (1981) that fire frequency decreased with latitude:

> ...wildfire was commonplace in the Swan Valley. Fire-scarred ponderosa pines, charcoal in the soil layers, and the occurrence of even-aged stands of lodgepole pine...attest to the past presence of fire; the relative scarcity of old growth climax forests provides further insight into the influence of historic fire (Freedman and Habeck 1984:24).

The fire history analysis indicates that the [lower elevation portions of the Swan valley] was burned frequently; in the drier southern half...the intervals were shorter than on the more moist northern part. Between 1758 and 1905 this portion of the range had fire-free intervals of about 30 years, and the presence of western larch and even-aged lodgepole pine suggests the fires were of higher intensity....The remaining samples are from the southern end [i.e. south of the South Lost project area], and these have a shorter interval of 17 years (Freedman and Habeck 1984: 27).

8. Fire History in South Fork Lost Creek Canyon

The following excerpt is from an ecological fire analysis report on the South Fork Lost Creek Drainage conducted by Stephen W. Barrett (1996). The analysis area mentioned in this report is the same as the project area.

An early forest survey (Ayres 1900) and archival maps (on file, USDA Forest Service Region One, Missoula) provided an initial landscape-scale perspective on fire's historical role near the Seeley-Swan valley. Ayres (1900) observed much evidence of fire throughout the valley, and mentioned that fires were widespread in the area about 1850 and 1889. The archival maps also depict a number of large fires after the turn of the century, for example, in 1910, 1919, 1920, 1929, 1934, and 1936. Although the largest of these fires missed the Swan valley, at least 30,000 acres burned in the valley from 1910 to 1936, particularly on the west side. The archival map also shows that a fire in 1920 burned several hundred acres in the South Fork Lost Creek project area, otherwise much of the watershed is occupied by mid-to-old-age stands.

Field sampling and data analysis (Arno and Sneck 1977, Barrett and Arno 1988) revealed the following patterns of long-term fire history in the sampling. These data were supplemented by stand exam data and aerial photographs (on file, Swan River State Forest), which produced a 5-century Master Fire Chronology and coarse-scale fire history map. The fire chronology, which spans from ca. 1460 to 1920, ends with the 1920 event because it was the last fire of any significance in the area. At least nine fires occurred during the 460-year period, yielding a mean fire interval (MFI) of about 58 years for the entire analysis area. Intervals between consecutive fires in the drainage ranged from 9 to 120 years, and the last substantial fire in the project area occurred in 1920; data end with 1995 fire season). By comparison, post-1950 fire suppression records (on file, Swan River State Forest) indicate that, on average, a lightning fire has occurred every 3 to 4 years in the project area. If lightning ignition patterns were similar over the past 5 centuries, then only one out of about every 15 ignitions evolved into a major fire. Clearly, most lightning-caused fires either expired without spreading, or developed into small patchy surface fires that did not significantly alter stand structures. This analysis cannot account for possible influence from frequent Indian-caused fires in the drier forests of the main Swan valley bottom. However, inherently high fuel moisture during most fire seasons in these productive habitat types probably would inhibit the spread of such fires into the analysis area itself.

Both the area MFI and the range of historical fire intervals in the drainage are useful for documenting how often canyons such as the South Fork Lost Creek drainage experienced major disturbance before fire exclusion began in this century. The number of years since the last spreading fire also can provide perspective on the influence of fire history and fire regime maps, allowing forest planners to infer the role of wildfire in changing landscapes over the past 5 centuries.

The sampling and aerial photographs verified that stand replacement fires have been dominant in the analysis area and elsewhere along the steep Swan front (Ayres 1900, Antos 1977). A mixed severity fire regime has been relatively common in the main valley bottom, and in localized areas within the South Fork Lost Creek drainage.

9. Summary of Historical Forest Conditions

The historical data indicate that forests in the SRSF and South Fork Lost Creek project areas were cooler and moister than the broad scale Climatic Section and western Montana averages. They were also considerably older with a far higher proportion of western larch/Douglas-fir cover types than at the broad scale. Although the forests of the SRSF were old, the representation of shade-tolerant tree cover types was low, indicating disturbance was frequent enough to prevent widespread cover type conversion through succession.

Forest patches tended to be large with relatively simple shapes. Old stands were particularly large averaging 696 acres in the SRSF and 1,339 acres in the South Fork Lost Creek project area. The western larch/Douglas-fir type covered more than 65 percent of the entire forest. White pine types were more common than would be expected from the Climatic Section average indicating a more maritime climatic influence. Mixed conifer and subalpine types together made up less than 15 percent of the forest.

Old western larch/Douglas-fir forests on the warm/moist HTG formed the matrix of the forest interspersed with patches of ponderosa pine on dry slopes and valley bottoms, and patches of older white pine and mixed conifer stands. Moving up in elevation to the cool/moist HTG, western larch/Douglas-fir types again formed the matrix, but were interspersed with large proportions of subalpine and mixed conifer types.

D. CURRENT FOREST CONDITIONS

Not all the data used to describe historical conditions are available for current conditions and not all of the data on current conditions can be used to determine historic conditions. The data presented represent those that are available rather than a selected set. Where possible, relationships between historical and current conditions are described using the most data sets for comparison. The information is presented in order from the largest scale to the smallest. The broad scale trends of decreased proportions of old stands, decreased shade-tolerant tree representation and corresponding increased shade-tolerant tree cover evident from the ICRB are also demonstrated at the SRSF level.

1. Data Sources

DNRC assessed current conditions with a Stand Level Inventory (SLI) that covers the entire state ownership in SRSF. Sources of historical data are described in section III.II.C.1.

2. Past Management Activities

Timber harvesting in the South Fork Lost Creek project area has occurred periodically since the early 1960s. Some harvesting in the early 1960s was in response to a spruce beetle outbreak. These old harvest units are located in the alpine terrain of the Cliff Creek drainage. Other harvesting occurred from 1962 to 1981. These harvest units are located mainly in the lower elevations along the South Fork Lost Creek road. One small harvest unit is located just across the South Fork of Lost Creek and two others are located on the ridge south of the South Fork of Lost Creek. No major harvest activity has occurred in this drainage since 1981.



Photo 3- Rugged terrain in the Cliff Creek drainage of the South Fork Lost Creek project area.

3. Cover Type Representation and Age Class Distributions

The current age class structure by cover type for the SRSF is shown in Table 3-9. Currently, 50 percent of all stands are 'old' versus an average historical proportion of 29 percent (from the Climatic Section). In the 1930s inventory, 74 percent of the SRSF existed as old stands. Old stand representation has decreased to more nearly reflect the average historical conditions. Also, there has been a very large shift in cover type representation since the 1930s from shade-intolerant (seral) species to the shade-tolerant climax species. The shift is especially prominent in the mixed conifer and subalpine fir types (up 420 percent and 390 percent respectively). The trend is similar across the entire ICRB where shade-intolerant species, in moist forests, have decreased by 86 percent while shade-tolerants have doubled compared to historical amounts (ICRBEMP, 1997), but more extreme within the SRSF.

The current inventory defines an old stand as any stand over 150 years of age, except for lodgepole pine over 140 years. Losensky (using the 1930s inventory) used break points of 170 or 180 years rather than the current breakpoint of 150 years. This apparent discrepancy results from the use of different methods to estimate age. The 1930s inventory used trees over 12-inch or 14-inch dbh to assign age (in sawtimber stands, and depending on species). The focus on high value large trees (e.g., larch, white pine, ponderosa pine, and Douglas-fir) causes the historical inventory to overestimate stand age compared to current procedures.

TABLE 3-9. CURRENT PROPORTIONAL AGE CLASS STRUCTURE BY COVER TYPE AND OVERALL COVER TYPES FOR THE SRSF.

Cover Type	0-39 years	40-99 years	100 yrs - Old Stands	Old Stands
Ponderosa Pine	50%	5	8	37
Douglas-fir	19	54	7	21
Western larch/Douglas-fir	36	19	6	38
White pine	6	1	12	81
Lodgepole pine	7	75	16	2
Mixed conifer	12	15	21	52
Subalpine types	15	19	18	48
TOTAL[2]	19[1]	17	14	50

[1] All non-stocked acres in the current inventory are assigned to a cover type.

[2] Totals do not add to 100 percent due to rounding, and acres of hardwood, water, and non-forest.

In comparison, existing DNRC inventory underestimates stand age by assigning the average age of all trees larger than 9 inches. The 150-year age limit is conservative when compared to 1930s estimates of 170 and 180 years. Many stands as young as 120 years in the current inventory probably would have been assigned an age of 170 or older in the 1930s inventory.

Age class distributions and cover type representation in the South Fork Lost Creek project area are shown in Table 3-10. Note the larger proportion of old stands in the South Fork Lost Creek area than the SRSF as a whole. Also, the project area is very heavily skewed to shade-tolerant species cover types. The two conditions indicate an area free from disturbance for many years (demonstrated in the fire regimes analysis).

TABLE 3-10. CURRENT AGE CLASS DISTRIBUTION AND COVER TYPE REPRESENTATION WITHIN THE SOUTH FORK LOST CREEK PROJECT AREA.

Cover Type	0-39 years	40-99 years	100 yrs - Old Stands	Old Stands
Ponderosa Pine	100%	0	0	
Douglas-fir	41	33	26	
Western larch / Douglas-fir	37	11	50	
White pine	7	4	90	
Lodgepole pine	0	0	0	
Mixed conifer	6	13	18	63
Subalpine types	30	23	47	
TOTAL [2]	18[1]	8	17	57

[1] All non-stocked acres in the current inventory are assigned to a cover type.

[2] Totals do not add to 100 percent due to rounding, and acreage of hardwood, water, and non-forested areas.

The HTG's indicate an appropriate condition would contain a higher representation of shade-intolerants than is currently the situation.

4. Habitat Type Groups and Cover Type Representation

The habitat type of a piece of ground and habitat type groups do not change over time. However, the cover types existing on any HTG can and do change with succession, fire, insects and disease. Table 3-6 shows the representation of habitat type groups on the SRSF and the SFLC project area. On the SRSF, the western larch / Douglas-fir cover type on the warm/moist HTG (the dominant HTG on the SRSF) has declined from 76 percent, in the 1930s, to only 28 percent currently. Concomittantly, the mixed conifer type has experienced a ten-fold increase in its representation from 4 percent historically to over 40 percent today.

The cool/moist type has seen a similar decline in western larch/Douglas-fir, from 42 percent historically to 15 percent currently, while the mixed conifer and subalpine types have increaed from 41 percent historically to 75 percent currently. Historically the western larch/Douglas-fir cover type was the most common on the entire forest and within every HTG. At present, however, the type is not predominant in any of the well-represented HTGs. However, on 331 acres (less than 1 percent of the SRSF) in the moderately cool and moist and moderately cool and dry HTGs western larch/Douglas fir is the most common cover type. Table 3-6 shows the representation of habitat type groups on SRSF and the South Fork Lost Creek project area.

5. Structural Characteristics

Current structural characteristics are defined as single-story, two-story or multi-story. Within the South Fork Lost Creek project area, 2,146 acres are in single-story stands (1,442 acres sawtimber); 76 acres are two-story sawtimber stands; 1,240 acres are multi-story sawtimber stands. In the past, the only structural measure was tied to age, so accurate comparisons to past conditions can not be made.

6. Patch Characteristics

Current patch characteristics of size and shape index by cover type are shown in Table 3-11. The table shows that patches in the South Fork Lost Creek project area tend to be larger than on the remainder of the SRSF, particularly the mixed conifer type. These large patches of mixed conifer reflect succession and the lack of disturbance and are approximately twice the size of historical mixed conifer patches. Patch shape complexity is roughly the same on SRSF as on the South Fork Lost Creek project area.

Some of this reflects real conditions, but some the 1930s sampling Furthermore, addition a single 7,000 + acre western larch / Douglas-fir stand from the early inventory has been fragmented into numerous stands through harvesting, and succession.

Patch sizes and shape indices for the SRSF and the South Fork Lost Creek project area by age class are shown in Table 3-12. Old stands in the project area are considerably larger and slightly less complex than for the SRSF. The reduction in old stand patch size since the 1930s inventory is especially obvious. Some of this reflects real conditions, but some is simply an artifact of the 1930s sampling method where considerable

TABLE 3-11. PATCH SIZE AND SHAPE INDEX BY COVER TYPE FROM THE CURRENT INVENTORY ON THE SRSF AND THE SOUTH FORK LOST CREEK PROJECT AREA. PATCH SIZE EXPRESSED IN ACRES FOR PATCHES OF EQUIVALENT COVER TYPE. PATCH SHAPE DERIVED FROM THE INDEX OF MCGARIGAL AND MARKS (1994).

Age Class	Average Patch Size (acres)		Patch Shape Index	
	SRSF	South Fork Lost Creek	SRSF	South Fork Lost Creek
Ponderosa Pine	43	12	1.27	1.12
Douglas-fir	24	10	1.35	1.02
Western larch / Douglas-fir	68	30	1.35	1.33
White pine	106	119	1.67	1.86
Lodgepole pine	48	0	1.36	na
Mixed conifer	143	279	1.55	1.56
Subalpine types	138	144	1.43	1.35
Water	21	0	1.60	na
Hardwood	22	0	1.68	na
Non-forest	18	19	1.40	1.76
AVERAGE	80	125	1.44	1.48

TABLE 3-12. PATCH SIZE AND SHAPE INDEX BY AGE CLASS FROM THE CURRENT INVENTORY ON THE SRSF AND THE SOUTH FORK LOST CREEK PROJECT AREA. PATCH SIZE IS EXPRESSED IN ACRES FOR PATCHES OF EQUIVALENT AGE. PATCH SHAPE DERIVED FROM THE INDEX OF MCGARIGAL AND MARKS (1994).

Age Class	Average Patch Size (acres)		Patch Shape Index	
	SRSF	South Fork Lost Creek	SRSF	South Fork Lost Creek
0 - 39	37	38	1.42	1.42
40 - 99	63	103	1.45	1.42
100 - Old Stands	48	53	1.43	1.39
Old Stands	211	298	1.73	1.59
AVERAGE	72	95	1.48	1.44

lumping of stands occurred. A single 7,000 + acre western larch/Douglas-fir stand from the early inventory has been fragmented into numerous stands through harvesting and succession. Additionally, a more intense sampling scheme with a smaller minimum patch size has artificially broken up that large patch in the GIS.

7. Stand Vigor

Stand vigor is improved when slow-growing, diseased, or insect-infested trees or stands are harvested and replaced with new growth through regeneration.

The four generally recognized vigor classes are: full, good-to-fair, fair-to-poor, and very poor.

Full vigor. Forests in this class have an open canopy and growth is optimal. An example of a stand in this class would be young, immature, and probably in the seedling or sapling stage. Only 139 acres within the project area are at full vigor.

Good-to-fair vigor. Stand canopies are mostly closed with crown ratios (the vertical height of a tree's crown compared with the total vertical height of the tree) between 33 and 50 percent. Growth rates exceed mortality in these stands. A stand in this class would be young, merchantable saw timber. Good-to-fair vigor stands occupy 2,488 acres in the project area, of which 226 are at risk to insects and disease.

Fair-to-poor vigor. Stand canopies are tightly closed with crown ratios less than 33 percent. Growth and mortality rates are nearly balanced. An example of a stand in this class would be an old stand of merchantable saw timber. Fair-to- poor vigor stands occupy 1,198 acres in the project area, of which 719 are at risk to insects and disease

Very poor vigor. Stands in this class are similar to the fair-to-poor class, but generally are in a decadent condition caused by competing vegetation, insects, diseases and/or old age. Typically in these stands, mortality rates exceed growth rates. Poor vigor stands occupy 206 acres in the project area, all of them at risk to insects and disease.

Light- and moderate-reserve silvicultural treatments would return stands to full vigor; heavy-reserve treatments would raise vigor by one class, e.g., from the poor to fair class into the fair to good class. Structural enhancement would raise vigor by one class in the fair-to-poor or very poor classes, but would not be expected to affect the good-to-fair- or full-vigor classes.

8. Insects and Diseases

Insect and disease infestation levels in the project areas are what would be expected. Bark beetles, armillaria root rot, dwarf mistletoe, white pine blister rust and Indian paint fungus are the main insects and diseases that occur within these habitat type groups. Root diseases play a major role in regulating stand composition and stocking forest types in the area (Monnig and Byler 1992). Under natural conditions, Douglas-fir and true firs tend to be susceptible to root disease. Stands dominated by more-resistant species such as western larch and western white pine are perpetuated where root disease is present.

TABLE 3-13. MINIMUM PROPORTION OF SRSF TO MAINTAIN AS OLD STANDS FOR EACH COVER TYPE. THE AVERAGE PROPORTION INDICATES THE PROPORTIONAL AREA OCCUPIED BY EACH COVER TYPE FROM THE CLIMATIC SECTION.

Cover Type	Proportion of area Historical	Old stand proportion Losensky *	One half of Losensky's proportion	Proportion of area to manage as old stands
Ponderosa pine	1%	74	37	0.37
Douglas-fir	less than 1	6	3	0.03
Western larch / Douglas-fir	28	47	24	6.72
White pine	1	17	9	0.09
Lodgepole pine	27	5	3	0.81
Spruce-fir (Mixed conifer)	6	43	22	1.32
Subalpine	36	20	10	3.60
			TOTAL	12.94

*The old-stand proportion from Losensky is the proportion of each cover type that was over 170 years old for ponderosa pine, Douglas-fir, and western larch/Douglas fir; over 140 years for lodgepole pine, and over 180 years for the other types.

9. RELATIONSHIP TO SFLMP OLD GROWTH COMMITMENT

The SFLMP requires the maintenance of old growth in amounts equal to at least one half of that expected to occur with natural conditions (see page III-2, Old Growth Commitments from the SFLMP). This section describes how to determine that minimum. The management for old stand (old growth) amounts is best conducted for the entire SRSF so as to avoid homogeneous forests spread across the landscape with equivalent proportions of cover types and age classes in each. Such an approach also facilitates the development and maintenance of large blocks of contiguous old growth and provides for the mechanisms to maintain and enhance connection between old stands.

The minimum proportions of old stands to be retained, by cover type, are calculated by multiplying the proportion of the climatic section in each cover type, by one half the proportion of each cover type that historically existed as old stands. The product is then multiplied by the acres of the Swan River State Forest to indicate minimum acres of old stands to maintain.

Cover types were assigned from DNRC's current Stand Level Inventory to cover types matching those described in the historical data. Table 3-14 takes the minimum proportions from Table 3-13 and multiplies them by the acres in the SRSF to determine the minimum acres of old stands to maintain in particular cover types. It also shows the current representation of old stands. As shown in Table 3-14, there are sufficient acres of old stands in all but the lodgepole pine classes; the lodgepole type currently does not exist in the project area and thus would not be affected.

TABLE 3-14. THE MINIMUM NUMBER OF ACRES IN THE SRSF TO BE MAINTAINED AS OLD STANDS FOR EACH COVER TYPE.

Cover Type	Proportion of SRSF to manage as old stands	Minimum acres to maintain as old stands on SRSF	Existing acres of old stands on SRSF
Ponderosa pine	0.37%	143	761
Douglas-fir	0.03	12	82
Western larch / Douglas-fir	6.72	2,598	3,708
White pine	0.09	34	4,723
Lodgepole pine	0.81	313	51
Mixed conifer	1.32	510	7,928
Subalpine	3.60	1,392	1,538
TOTAL	12.94	5,002	18,790

TABLE 3-15. REPLACEMENT OLD STAND SCHEDULE.

Cover Type	Old Stand Target	Percentage in 110 class and each of the younger classes	Percentage in each age class between 110 and 150[1]
Ponderosa Pine[2]	--	--	--
Douglas-fir	3	2.4	1.0
Western larch / Douglas-fir	24	3.5	2.5
White pine	9	3.2	1.9
Lodgepole pine[3]	3	1.8	0.8
Mixed conifer	22	3.5	2.5
Subalpine	10	3.3	2.0

[1] The 150 class is used because in DNRC inventory that class corresponds best to Losensky's old stand designations.
[2]Ponderosa pine - not applicable because targeted management is intended to create the conditions desired
[3] Lodgepole pine becomes old stands at 140, so the 0.8 refers to the 140 and younger classes to 110.

10. REPLACEMENT OLD STAND SCHEDULE

The SFLMP calls for the maintenance of sufficient stand acres to replace old stands that may fall apart, die or burn. The proportions were calculated using a Weibull function for age class distribution. The Weibull function uses both the fire return interval and a shape parameter to fit the age class curve. This curve indicates the proportion of stands needed in each age class. Table 3-15 shows the cover types and the percentages of stands needed in the 110-year age class and younger age classes, and the percentages necessary for the age classes between 110 and 150 years. Age classes cover 10 years, e.g., the 110 class is from 110 to 119 years.

Only the western larch/Douglas-fir type is short of acres of replacement old stand acreage in the 110 to 150 year age classes with 6 percent of the acres in the type (see Table 3-9). The recommended amount is 10 percent. This problem is largely alleviated by

the excess of existing old western larch/Douglas-fir acres beyond the SFLMP preservation commitment (9.6 percent present, 6.7 percent required by commitment). All other types have many more acres than the stipulated mi nimum for replacement old stands.

11. Current Forest Condition Summary

The data indicate that SRSF and the South Fork Lost Creek project area in particular are considerably older forests, with greater shade-tolerant tree representation than would be expected to occur under average historical conditions. However, old forests have decreased since the 1930s from 74 percent of the SRSF to 50 percent currently, thereby moving the forest toward the historical average of 29 percent. Fifty-nine percent of the project area is in old stands. SRSF currently has 3.5 times more acres of old stands than the minimum commitment from the SFLMP, although much of the over representation is concentrated in mixed conifer and white pine stands.

Cover type of old stands has shifted from shade-intolerant dominated (94 percent of historical old stands) to domination by mixed conifer and subalpine cover types (60 percent of old stands). The historical matrix of old western larch/Douglas-fir stands has been replaced, but by no single type or age class. The project area contributes significantly to the shifting cover type trend. The old, shade-tolerant dominated stands in the South Fork Lost Creek drainage are also of generally less than full vigor, with a high proportion of them at risk.

The SRSF is more fragmented, with smaller cover type patch sizes than historically. Patches of old stands also have decreased in size, although patch size still averages over 210 acres on the whole forest and 298 acres in the project area. Patch shape complexity on the SRSF is similar to that on the project area, but the shape of old stand patches is less complex on the project area.

The information shows a forest heavily affected by forest succession. The potential for large, catastrophic fires, and increased loss to insects and diseases is high, given the shifts in cover types.

The information shows a forest heavily affected by forest succession, resulting from effective fire suppression and a lack of wildfire. The potential for large, catastrophic fires and increased loss to insects and diseases is high, given the shifts in cover types.

III. NOXIOUS WEEDS

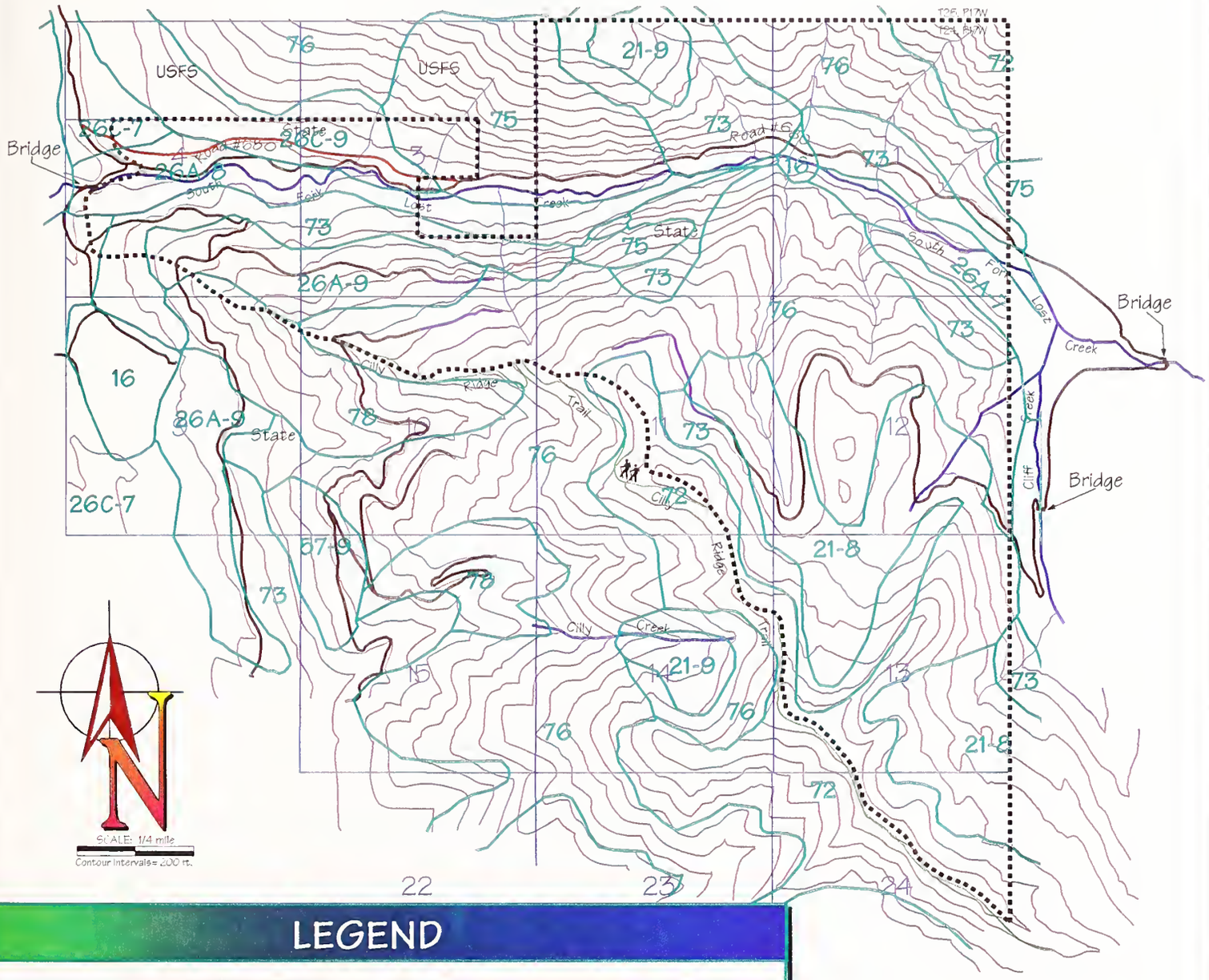
Spotted knapweed (*Centaurea maculosa*) and common St. Johnswort (*Hypericum perforatum*) occur on dry sites within the project area, mainly along road edges exposed to sunlight.

IV. SOIL

A. Soil Types

Soil types in the project area range from rock outcrops and fractured bedrock to gravelly silt loam with volcanic ash topsoil. Most of the proposed project area has thin surface soils or none at all, and are at a high risk for loss of productivity if displaced (Figure 3-1 and Table 3-16). No soils prone to landslides or mass failure have been found in the project area.

Figure 3.1
South Fork Lost Creek
Soils Map*



LEGEND

- Existing Roads
- Proposed Road Relocation
- Proposed Roads
- Perennial Streams
- Intermittent Streams
- *Refer to Table 3-16
- Project Area Boundary
- Soil Type (21-9)
- Cilly Ridge Trail #108

TABLE 3-16. SOIL TYPES AND RISKS IN THE SOUTH FORK LOST CREEK PROJECT AREA.

Map Unit	Description	Soil Drainage	Road Limitations	Topsoil Displacement & Compaction	Seedling Estab-lishment	Erosion (Bare Surface)
10-2	Stream Bottoms	Good	High Water Danger	Low	Moderate	Severe
16	Alluvial Fans	Poor	Seeps, Raveling	Severe	Good	Moderate
21-8	Cirque Basins, 20-40%	Poor	Rock Outcrops	Severe	Poor	Moderate
21-9	Cirque Basins, 40-60%	Fair	Rock Outcrops	Severe	Poor	Low to Moderate
26A-7	Glacial Till, 10-20%	Poor	None	Severe	Moderate	Moderate
26A-8	Glacial Till, 20-40%	Poor	Unstable cut banks	Severe	Good	Moderate
26A-9	Glacial Till, 40-60%	Fair	Unstable cut banks	Severe	Good	Moderate
26C-7	Glacial Moraines, 10-20%	Poor	None	Moderate to severe	Fair	Moderate
26C-9	Glacial Moraines, 40-60%	Fair	Unstable cut banks	Moderate	Good	Moderate
26D-7	Glacial Moraines, 10-20%	Poor	None	Moderate to severe	Fair	Moderate
57-8	Glaciated Mountain Ridges	Good	None	Moderate	Fair	Moderate
72	Alpine Ridges	Poor	Rock outcrops, avalanches	Low	Poor	Slight
73	Glacial trough walls	Good	Rock outcrops, unstable cut banks	Moderate	Fair	Moderate
75	Rock outcrops	None	Severe	None	None	None
76	Structural Breaklands	Good	Steep slopes, rock outcrops	Moderate	Poor	Moderate to high
78	South facing rock outcrops	Well	Steep slopes, rock outcrops	Moderate	Fair	Moderate to high

B. Roads

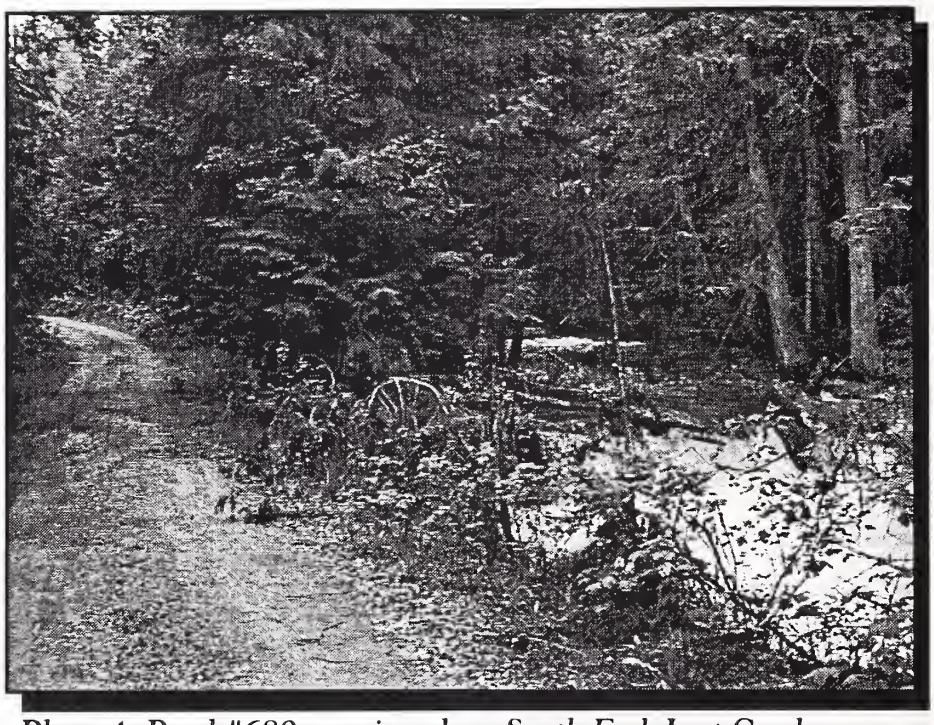


Photo 4- Road #680 running along South Fork Lost Creek.

Roads to the proposed project area are mainly of low to moderate standard, and would need varying degrees of work to meet Best Management Practices (BMP). The main access route to the watershed is on the South Fork Lost Creek Road, which has surface drainage problems over most of its length. The road has little or no surface drainage installed, and some reaches are constructed within the Streamside Management Zone (SMZ). Beyond the locked gate at the concrete bridge, the road becomes low standard, and has some severe erosion problems in the Cliff Creek portion of the watershed. Old harvest units located in sections 11, 12 and 13 have a series of skid trails excavated on 100-foot contours, with no surface drainage structures or relief pipes. These trails have numerous small trees growing in them, but not much ground-covering vegetation to slow erosion. Most of them are actively eroding and producing deep gullies and mass failures. Most of the harvest units in the lower reaches of the watershed are on more moderate slopes, and skid trail spacing is closer to 150 feet. Some displacement has occurred on these trails, effectively removing the shallow silt loam topsoil. These trails are neither revegetating nor actively eroding.

V. WILDLIFE

A. Threatened and Endangered Species

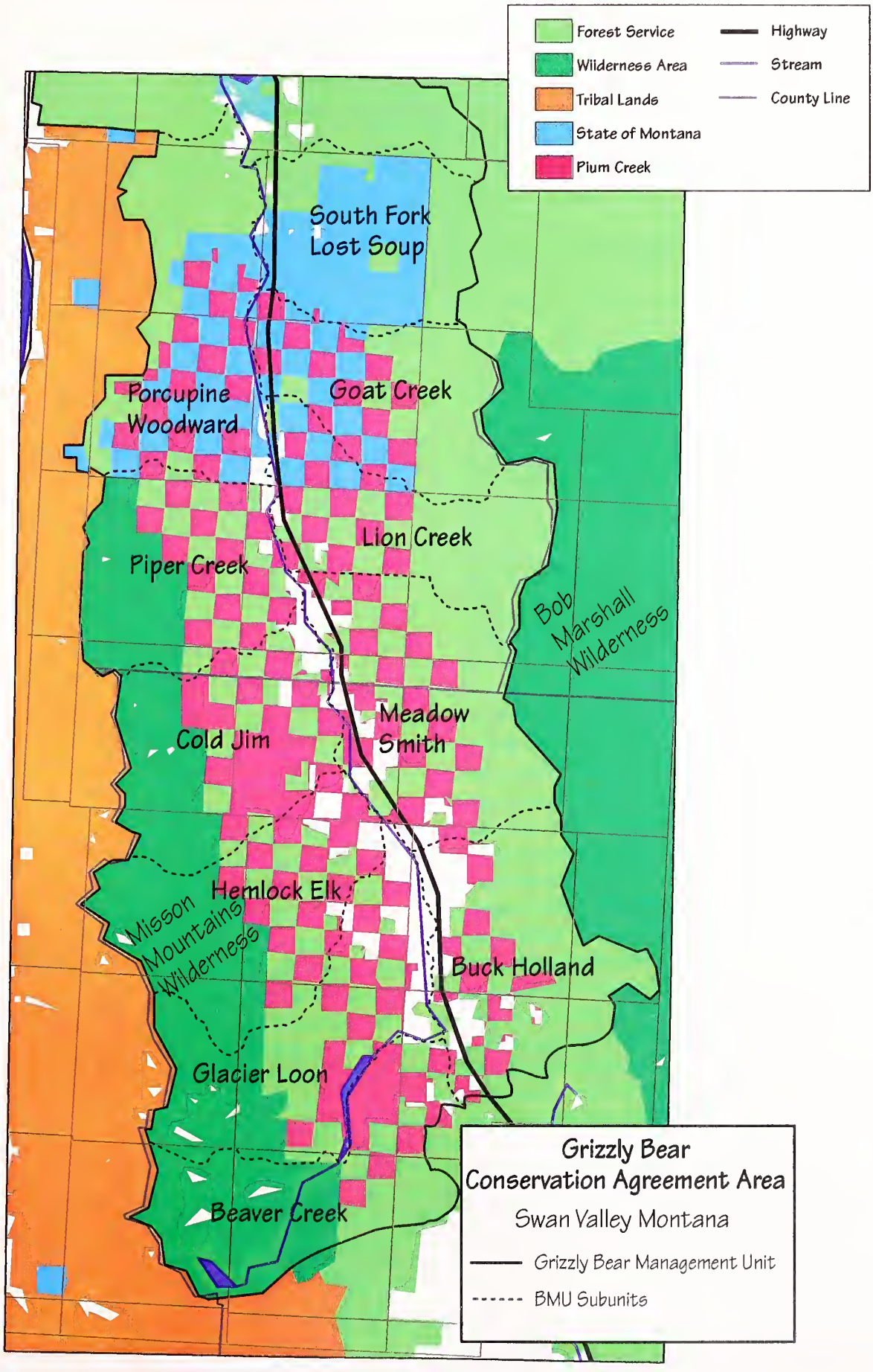
This EIS addresses four terrestrial wildlife species that are on the U.S. Fish and Wildlife Service threatened and endangered species list:

1) Grizzly Bear
2) Wolf
3) Bald Eagle
4) Peregrine Falcon.

1. Grizzly Bear

In 1995, the Swan Valley Grizzly Bear Conservation Agreement (SVGBCA) was signed by DNRC, the Flathead National Forest, Plum Creek Timber Company, and the U.S. Fish and Wildlife Service. The agreement establishes grizzly bear habitat management standards and guidelines for the Swan Valley Conservation Area (USFWS 1995b, 1995c). The DNRC State Forest Land Management Plan (1996) specifies that projects on the Swan River State Forest shall be managed in compliance with the SVGBCA.

Figure 3.2
South Fork Lost Creek
Grizzly Bear Conservation Agreement Area



A) Analysis Area

The Swan Valley Conservation Area is within the Northern Continental Divide Ecosystem (NCDE) Grizzly Bear Recovery Area. The NCDE comprises 23 Bear Management Units (BMU) (USFWS 1993). Each BMU is further divided into subunits, each of which covers approximately 50 square miles. The proposed South Fork Lost Creek timber sale project area is within the South Fork Lost Soup Subunit of the Bunker Creek BMU (Figure 3-2). The South Fork Lost Soup Subunit encompasses 29,923 acres (46.8 square miles) in the drainages of the South Fork of Lost Creek, Cilly Creek and Soup Creek. DNRC manages 62 percent (18,446 acres) of the subunit, the Flathead National Forest administers 36 percent, and Plum Creek owns approximately 1 percent. Other private landowners own about 1 percent of the subunit.

B. Analysis Methods and Existing Environment

Hiding cover is one of two variables for which the SVGBCA has defined a standard for all subunits. SVGBCA specifies that each party would "manage their lands so that a minimum of 40 percent of all land in each BMU Subunit in the Conservation Area is maintained in cover." Estimates from stand level inventory data and aerial photo interpretation show that approximately 79 percent of the entire South Fork Lost Soup BMU Subunit and 91 percent of DNRC land within this subunit provide grizzly bear hiding cover.

Open road density is the second habitat attribute for which the SVGBCA has specified a threshold to be calculated for every subunit. It states that "the Parties will manage roads throughout the Conservation Area so that no more than 33 percent of any given BMU Subunit exceeds an open road density of one mile per square mile during the Restricted Period" (to be accomplished by December, 2000). The Restricted Period, April 1 through November 15, approximates the time during which grizzly bears are out of their dens and roaming at large. Open road densities are calculated using a "moving windows" technique (Ake 1995). For this analysis, EPPL7 computer software (Minnesota LMIC 1991) was used to calculate road densities and areas meeting core area spatial criteria. Currently, 28 percent of the South Fork Lost Soup Subunit exceeds an open road density of 1.0 miles per square mile. For the DNRC portion of the subunit, 34 percent exceeds an open road density of 1.0 mile per square mile.

Although SVGBCA does not contain a total road density standard applicable to DNRC and Plum Creek, road density is to be monitored to assist the Flathead National Forest in meeting its standards. Currently, 45 percent of the South Fork Lost Soup Subunit exceeds a total road density of 2.0 miles per square mile.

SVGBCA also establishes guidelines on the timing and other conditions for harvest operations within cutting units and specially designated habitats in the Conservation Area. Specially designated habitats include "Linkage Zones," "Low-Elevation Linkage Zones," "Preferred Habitats," "Riparian Zones," and "Core Areas."

The U.S. Fish and Wildlife Service has delineated four Linkage Zones in the Conservation Area (Servheen and Sandstrom 1994). Approximately 240 acres of the project area (in Sections 13 and 24) are within the Swan River State Forest Linkage Zone (USFWS 1995b Attach. E). None of the project area is within the low elevation portion of this linkage zone (USFWS 1995b: Attach. H1).

Preferred Habitats are designated habitats adjacent to streams and wetlands inside Linkage Zones (USFWS 1995b: Attach. G). No Preferred Habitats are designated in the project area.

Riparian Zones are Streamside Management Zones as defined in the Montana Streamside Management Zone (SMZ) rules (1993). Riparian Zones occur within the project area and are delineated in Attachment F of the SVGBCA. Additional Riparian Zones may be identified during on-the-ground layout of a timber sale. The SVGBCA specifies that only uneven-aged forest management practices shall occur in Riparian Zones in the Swan Conservation Area.

Core areas are free of motorized access during the non-denning period (IGBC 1994). Core areas are at least 2,500 acres in size and a minimum of 0.3 miles from open and restricted roads, motorized trails, and non-motorized trails that receive high intensity use (U.S. Fish and Wildlife Service). Thirty-eight percent of the South Fork Lost Soup BMU Subunit meets core area criteria; 28 percent of DNRC land in the subunit meets the spatial definition of core area.

2. Wolf

At present, no wolves are known to occur in the Swan valley. However, wolves are increasing in numbers and distribution by natural recolonization in western Montana. The proximity of the Swan valley to existing wolf packs makes it a plausible locale for colonization by dispersing wolves. While the similarity of the Swan valley to areas already occupied by wolves suggests that it could support them, the steep broken topography and low prey density make the project area low quality wolf habitat.

3. Bald Eagle

The bald eagle is classified as threatened and is protected under the Endangered Species Act. Strategies to protect the bald eagle are outlined in the Pacific States Bald Eagle Recovery Plan (U.S. Fish and Wildlife Service 1986) and the Montana Bald Eagle Management Plan (Montana Bald Eagle Working Group 1994). Management direction involves identifying and protecting nesting, feeding, perching, roosting, and wintering/migration areas (U.S. Fish and Wildlife Service 1986, Montana Bald Eagle Working Group 1994).

The eagle nest nearest the proposed project is 6 miles away on the shore of Swan Lake. The project area is outside the recommended 2.5 mile home-range management radius surrounding the nest. The closest documented eagle roost site is over 5 miles from the project area boundary (McClelland 1995). The project area also is outside potential nesting habitat along the Swan River. Bald eagles are not known to winter in the project area, and timber harvesting would not affect migration behavior.

4. Peregrine Falcon

The peregrine falcon is classified as endangered in Montana, and is protected under the Endangered Species Act. Strategies to protect and recover populations are outlined in the American Peregrine Falcon Recovery Plan (U.S. Fish and Wildlife Service 1984).

Peregrine falcons may travel up to 18 miles from the nest in search of prey. They feed almost exclusively on birds, preferably ducks, shorebirds and songbirds. Hunting habitats include river bottoms, lakes, meadows, marshes, and cropland. No such areas exist within the project area. Foraging opportunities exist along Swan River, approximately 4 miles west of the project area, and at Swan Lake, 4 miles northwest.
Only one pair of peregrine falcons has been observed in the Swan valley during the nesting season in recent years, in 1993. The pair is thought to nest approximately 15 miles northwest of the project area, although nesting has not been confirmed. No other peregrine falcon nesting is suspected in the Swan valley (Warren 1995).

B. Sensitive Species

The SFLMP directs DNRC to give special consideration to the following species when conducting forest management activities: boreal owls, fisher, lynx, pileated woodpecker, western big-eared bat, northern bog lemming, flammulated owl, black-backed woodpecker, common loon, harlequin duck, and Coeur d'Alene salamander. These species are sensitive to human activities or have special habitat requirements that may be altered by timber management, or may become listed under the federal Endangered Species Act unless management can improve their long-term prospects. Because sensitive species usually have specific habitat requirements, consideration of their needs serves as a useful "fine filter" for ensuring that the primary goal of maintaining healthy and diverse forests is met.

Five of these species (flammulated owl, common loon, harlequin duck, Coeur d'Alene salamander, northern bog lemming) would not be affected by the proposed project (see Appendix C for details). The remaining six are discussed below.

1. Black-backed Woodpecker

The black-backed woodpecker requires areas with high concentrations of recently dead trees and logs for feeding. Feeding trees usually have been dead less than two to three years and harbor high concentrations of wood-boring insects, particularly larvae and pupae of bark beetles. Black- backed woodpecker habitat is primarily recently burned areas and patches of unburned insect-infested trees. Nest trees are at least 17 inches dbh, have heart rot, and usually are located in dense patches of green trees.

No fires have occurred in or near the project area in the recent past, and although scattered individual trees exhibit bark beetle activity, there are no concentrations of insect-infested trees within the project area. The project area thus does not currently contain suitable black-backed woodpecker habitat. Fires or insect outbreaks that might occur in the mature stands in the area could provide future habitat for black-backed woodpeckers.

2. Western Big-eared Bat

These bats roost and breed communally in groups from 12 to 200 individuals in caves, mine shafts, rock outcrops, lava tubes, and sometimes in buildings. Tree cavities occasionally are used as roosts. This species probably is limited by the number of suitable communal roost sites surrounded by adequate foraging habitat. Western big-eared bats are thought to be widely distributed throughout the northern region (USFS 1989), and are suspected to exist in the Swan valley (Reichel 1997). This species is extremely sensitive to human activities and they have been known to permanently abandon roost sites in response to disturbance, recreational cave exploration in particular. The rocky outcrops in sections 2 and 3, and scattered individual trees, may provide roosting habitat.

3. Boreal Owl

Boreal owls in Montana inhabit mature to old growth forests at elevations from 5,000 to 8,000 feet. Nesting in the Rocky Mountains has been documented in subalpine forest dominated by subalpine fir and Englemann spruce. Such forests are structurally complex, and have high densities of large trees, shrubby and open understories, and a multilayered canopy. Boreal owls are secondary cavity-nesters, using holes excavated by pileated woodpeckers and flickers. Habitat quality depends strongly on the availability of large snags and trees with cavities suitable for nesting. Boreal owls apparently are not sensitive to human or mechanical disturbance. Effects of forest fragmentation on boreal owls have not been studied (Hayward 1994).

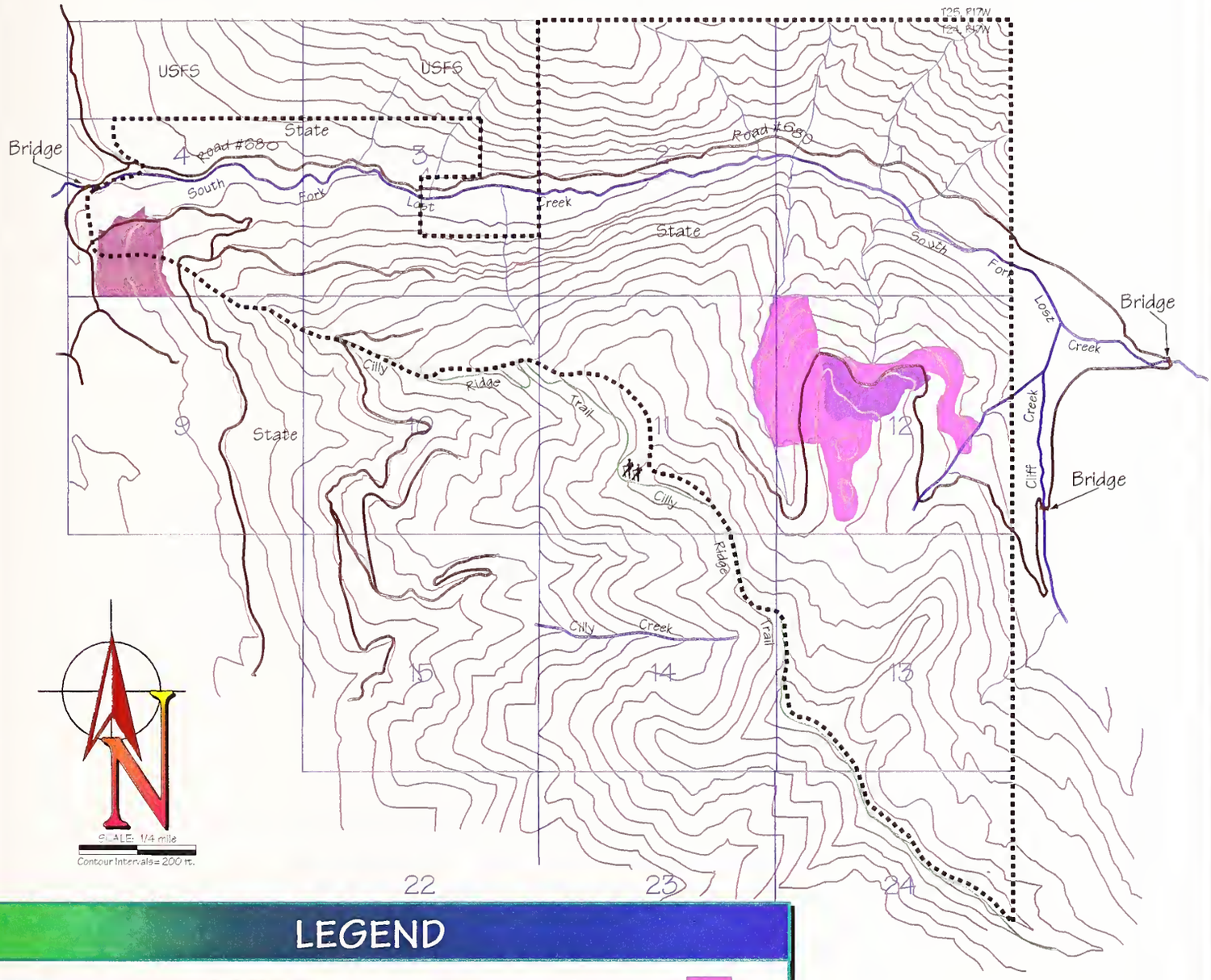
The DNRC stand level inventory (SLI) data were used both on the SRSF and on the project area to categorize stands that had the tree species and structural components known to be important to boreal owls. Stands were categorized as "high quality" boreal owl habitat if the following criteria were met: (1) above 5,100 feet in elevation, (2) average tree age in stand is greater than 149 years, (3) average tree dbh is greater than 14 inches, (4) canopy cover is greater than 40 percent, (5) stand is mature and exhibiting at least some signs of decadence, (6) the stand is composed of at least 50 percent subalpine fir and\or spruce, (7) the stand contains some live or dead western larch or ponderosa pine trees.

Using these seven criteria, eight stands totaling 591 acres were identified on the SRSF; 201 of these acres are on the project area, in one patch (Figure 3-3). These stands probably provide good to excellent boreal owl habitat. The seven criteria may fail to identify additional stands that could provide suitable habitat. In particular, stands containing larch and ponderosa pine snags but no live trees of these species would be excluded because the SLI only records species of live trees. Further investigation showed that 29 stands totaling 1,373 acres (247 in the project area) met the first six criteria.

4. Fisher

In the Rocky Mountains, fisher appear to prefer riparian areas in late-successional coniferous forests. Such areas probably are selected because they provide both resting and denning sites and dense canopy cover. For resting and denning sites, fisher require large live trees, snags, and logs, which typically are found in late-successional conifer forests. Dense canopy cover is important for snow intercept. Fisher have difficulty traveling in deep fluffy snow and appear to be restricted to areas with relatively low

Figure 3.3
South Fork Lost Creek
Boreal Owl and Pileated Woodpecker Habitat Map



LEGEND

- Existing Roads
- Perennial Streams
- Intermittent Streams
- Project Area Boundary
- Cilly Ridge Trail #108
- High Quality Boreal Owl Habitat
- Medium Quality Boreal Owl Habitat
- Pileated Woodpecker Habitat

snow accumulation (Powell and Zielinski 1994).

Fishers are generalist predators and take any animal they can catch, such as hares, squirrels, porcupines, mice, voles, and birds. They also scavenge for carrion and fruits. Because of the wide variety of forest types and seral stages where they can forage, populations usually are limited by requirements other than foraging habitat (Powell and Zielinski 1994).

Areas in the South Fork of Lost creek watershed had to meet the following criteria in order to be categorized as providing potential fisher denning and resting habitat: (1) elevations below 6,000 feet; (2) forest cover type is cedar, Douglas-fir \ larch, grand fir, larch, mixed conifer, mountain hemlock, spruce, or Douglas-fir, (3) forests are mature sawtimber or older, (4) the stand has at least 70 percent canopy cover throughout, or at least 50 percent canopy cover of dominant trees, and (5) area is within 165 feet of a perennial stream or within 83 feet of an intermittent stream. This analysis was restricted to the watershed and not done for the entire SRSF because it requires site-specific knowledge on duration of stream flow.

Some previously harvested acreage within these stream buffer zones might eventually provide fisher habitat when they have regrown sufficiently but do not yet provide enough cover to be categorized as fisher habitat. Most of the area within 165 feet of perennial streams and within 83 feet of intermittent streams is currently mature forest and provides potential fisher habitat (Table 3-17).

Any use of the project area by fishers would vary by season (Jones 1997). Most of the project area probably would be good summer habitat with use concentrated in riparian areas, and all but the highest elevation forests are usable for foraging and travel. Because much of the project area is at high elevations and usually has deep snow from December through May, use by fishers during the winter is probably minimal and restricted to the riparian corridor along South Fork Lost Creek.

Most of the project area could be used for travel and foraging during the snow-free months (Jones 1997). The most likely travel routes for fishers between the South Fork Lost Creek watershed and adjacent watersheds are in the western end of the project area near the outlet of South Fork Lost Creek and over nearby ridges. Eastward travel would be predominately through the South Fork Lost Creek riparian corridor. Although fishers avoid non-forested areas and prefer mature forest, old cutting units can

TABLE 3-17. POTENTIAL FISHER HABITAT IN THE SOUTH FORK OF LOST CREEK WATERSHED.

Ownership within watershed	Perennial streams (areas within 165 ft of streams)			Intermittent streams (areas within 83 ft of streams)		
	linear stream distance	total acres	acres without cover	linear stream distance	total acres	acres without cover
State	5.5 mi	208	26	2.0	41	0
USFS	7.8 mi	290	39	0.2	4	0

Only streams that naturally could support mature forest were included, with avalanche chutes excluded. Areas without cover are sites capable of providing fisher habitat but have been previously harvested.

be used for travel and foraging once the tree crowns touch. This preference for overhead cover during summer probably is related to avoidance of aerial predators (Jones 1997).

Adequate cover for travel currently exists in the seedling\sapling stands (seven stands, totaling 226 acres) in the lower elevation, western part of the project area during the summer and fall when shrubs are in full foliage (Jones 1997). Although tree cover in these areas is only about 40-60 percent, shrub cover is quite dense. About 44 of these acres are scheduled for pre-commercial thinning in 1999 and 2001, and would not provide cover for probably 10-20 years following thinning. The high elevation seedling\sapling patch in the southeastern part of the project area (totaling 396 acres), has tree canopy of about 20 percent, but has very high shrub cover. It is unknown whether cover in this area is adequate for fisher travel.

Heavy trapping pressure extirpated fishers from the Northern Rockies by the 1930s. They were reintroduced in the 1950s and 1960s in an attempt to reestablish this native species. The reintroduction was partly in response to the increase in porcupine populations that resulted from the elimination of the fisher, their primary predators. Fisher inhabit this area again, but populations remain vulnerable to trapping because they are easily caught not only in traps set for them but also for other animals.

Trapper access on roads into preferred fisher habitat can have a major influence on fisher populations (Powell and Zielinski 1994). The main access road into the project area currently runs generally parallel along the north side of the South Fork of Lost Creek. Road distance from the creek ranges from about 5 feet to 1,000 feet, averaging about 150-200 feet. About a half mile of the road is within 30 feet of the creek. The entire road is open year-round although it is not a through-route which would be preferred by trappers.

5. Lynx

Lynx are associated with boreal and montane forests. Lynx habitat in western mountains consists primarily of early successional forest with plentiful snowshoe hares, mature forest for denning and cover for kittens, and densely forested cover for travel and security. Numerous lynx tracks have been observed in the project area (Gray 1997).

Lynx are highly dependent on snowshoe hares for prey. One study found that dense young stands of lodgepole pine are optimal snowshoe hare habitat. No such areas exist in the project area. Snowshoe hare tracks and scat are readily visible in the project area, although it is not known how hare densities here compare to other areas. A lynx habitat suitability assessment determined that habitat suitable for snowshoe hares extends across the Swan valley floor (USFS 1994)

Habitat suitable for lynx denning in the Swan valley is in mature spruce-fir forests at elevations of 5,000 feet and above (USFS 1994). Preferred denning sites have abundant downed logs which provide security and thermal cover for kittens. Potential lynx denning sites probably exist in the high elevation spruce-fir forests in the southeastern part of the project area.

For travel, lynx require areas with continuous forest cover. Although lynx will move across open areas less than 100 meters wide, open areas discourage use by lynx and interrupt their movements. In general, suitable travel cover consists of vegetation

more than 6 feet tall with a closed canopy. All of the mature forest stands could be used for travel. All of the old cutting units probably provide adequate travel cover for lynx.

Males and young animals searching out new territory are particularly susceptible to trapping pressure. The road into the South Fork Lost Creek is open year-round (to snow vehicles in winter) and provides trappers with access to the project area.

6. Pileated Woodpecker

Pileated woodpeckers excavate the largest cavities of any woodpecker. Preferred nest trees and snags are larch, ponderosa pine, cottonwood and aspen, usually 25 inches dbh and larger. The pileated woodpecker plays an important ecological role in that the cavities they excavate are used in subsequent years by many other species of birds and mammals, including boreal owls (McClelland 1979). Pileated woodpeckers primarily eat carpenter ants which inhabit large downed logs, stumps, and snags. Habitat requirements, including large snags or decayed trees for nesting, and large downed wood for feeding, closely tie these woodpeckers to mature forests with old growth characteristics (Bull and Jackson 1995).

Pileated woodpeckers have large home ranges. The total home range area may comprise forested areas interspersed with non-forested and developed areas and a minimum of 500 acres of suitable feeding habitat may be needed to support a pair of pileated woodpeckers in the Rocky Mountains (McClelland 1979). Birds probably require less territory in forests that have more high quality snags, large trees, and downed wood.

The DNRC stand level inventory (SLI) data were used to categorize stands that had the tree species and structural components known to be important to pileated woodpeckers, both on the project area and the SRSF as a whole. Using the SLI, stands that met the following criteria were assumed to provide pileated woodpecker habitat: (1) average tree age in stand is at least 149 years, (2) average tree dbh is at least 16 inches, (3) canopy cover is at least 40 percent, (4) stand is mature and exhibiting at least some signs of decadence, and (5) the stand is composed of at least 40 percent western larch and\or cottonwood.

Using these criteria, 53 stands totaling 2,483 acres of pileated woodpecker habitat were identified on the SRSF. Of these, 2,349 acres are in stands greater than 40 acres, and 135 acres are in stands less than 40 acres. In the project area, one patch of 60 acres was identified as suitable for pileated woodpecker habitat (see Figure 3-3).

C. Big Game

Elk and mule deer are distributed throughout the project area from spring through fall. The project area receives limited non-winter use by white-tailed deer which are more commonly found at lower elevations west of the project area. The Montana Department of Fish, Wildlife and Parks has identified 230 acres of the project area (Sections 2 and 3, north of South Fork Lost Creek) as elk and mule deer winter range. Habitat models developed for elk also are used to assess the existing condition and impacts of proposed activities for mule deer (USFS 1993). See figure 3.4 for the big game analysis area.

1. Habitat Effectiveness

The analysis of elk and mule deer habitat during the non-winter period follows a method developed by the Montana Department of Fish, Wildlife and Parks, and the models developed by Flathead National Forest (USFS 1993) in northern Idaho (Leege 1984). The method assumes that each area has an inherent biological potential to support elk through the non-winter period. That potential is assigned a Habitat Effectiveness coefficient of 100 percent. The H.E. coefficient allows assessment of the existing condition and the effects of proposed actions within an analysis area; it does not allow comparisons of different analysis areas. Within an analysis area, reductions in hiding cover to below 40 percent, reductions in thermal cover to below 15 percent, and increases in the densities of cattle (AUM per square mile) or open roads (miles per square mile) reduce habitat effectiveness. This procedure does not address site specific habitat components such as moist sites, licks, or wallows.

Previous regeneration harvest areas in the project area are at least 20 years old. These old cutting units provide hiding cover but not summer thermal cover. Approximately 95 percent of the project area provides hiding cover and 82 percent provides summer thermal cover. No cattle are present in the project area. The only diminution of habitat effectiveness is from 4.1 miles of open road (0.61 miles per square mile) which reduces the existing H.E. coefficient to approximately 71 percent of potential elk use.

2. Elk and Mule Deer Winter Range

Winter thermal cover for elk and mule deer is defined as greater than 50 percent coniferous canopy coverage during the winter (larch does not contribute) at least 20 feet high, preferably in patches of at least 20 acres. Within the 230 acres of identified winter range in the project area, approximately 54 acres provide winter thermal cover in patches of 7, 11, 13, and 23 acres.

3. Elk Security

Elk security habitat is defined as an area of at least 250 acres which, during the autumn (hunting seasons), is at least 0.5 miles from an open road, provides thermal or hiding cover, and is "non-linear" in shape (Hillis 1991). Within the project area, 1,917 acres (44.5 percent of the project area) qualify as elk security habitat.

VI. WATERSHED

The entire project area lies within the South Fork of Lost Creek watershed. The South Fork of Lost Creek is a perennial tributary to the Swan River and drains 11,164 acres, which includes the Cliff Creek drainage (Figure 3-3). Annual precipitation in the watershed ranges from 25 inches where the creek meets Swan River to 70 plus inches on the upper ridges and headwater reaches. The upper watershed consists of very steep, rocky valley sideslopes, cliffs, and high gradient high energy streams. The South Fork of Lost Creek and Cliff Creek flow year-round. Numerous small tributaries to these reaches flow seasonally during runoff from snowmelt and rainstorms. Some small tributaries, particularly those in the avalanche chutes, flow year-round.

A. Water Quality

Timber harvest and related activities, such as road construction, can lead to water quality impacts by increasing production and delivery of fine sediments to streams. Harvesting trees leads to increases in water yields, which in turn can increase stream channel and bank erosion. Construction of roads, skid trails and landings generates and transfers substantial amounts of sediment through removal of vegetation and exposure of bare soil. Removal of vegetation near stream channels reduces sediment filtering capacity in these areas, and may reduce channel stability and amounts of large woody material in the channel. Large woody debris in the channel is an important component of stream dynamics, creating natural sediment traps and energy dissipators to reduce the velocity and erosiveness of stream flows.



Photo 5- South Fork Lost Creek.

1. Water Quality Standards

This portion of the Swan River drainage, including the South Fork of Lost Creek and Cliff Creek, is classified B-1 by the Montana Surface Water Quality Standards. Among other criteria for B-1 waters, no increases are allowed above naturally occurring levels of sediment, and minimal increases over natural turbidity. "Naturally occurring" includes conditions or materials present during runoff from developed land where all reasonable land, soil and water conservation practices (commonly called Best Management Practices or BMP) have been applied. Reasonable practices include methods, measures or practices that protect present and reasonably anticipated beneficial uses. These practices include but are not limited to structural and non-structural controls and operation and maintenance procedures. Appropriate practices may be applied before, during, or after completion of activities.

Designated beneficial water uses within the project area include aquatic life, cold water fisheries, and recreational use on the South Fork of Lost Creek and its tributaries. The South Fork of Lost Creek is not currently on the list of Water Quality Limited Waterbodies (303 [d] list), maintained by the Montana Department of Environmental Quality.

2. Current Water Quality Conditions

The primary impact to water quality in the South Fork of Lost Creek is related to numerous major avalanche chutes. These can carry large amounts of sediment and large woody debris to the creek. The woody material deposited in the creek has created numerous debris jams throughout the stream course, some of which are stable and some which are not. The unstable jams present a high potential for a large flush of sediment should they fail during high runoff. The South Fork Lost Creek road also is a sediment source to the creek in some of its lower reaches where it is located within the Streamside Management Zone (SMZ). Other roads within the watershed range from low to moderate standard, some of which do not currently meet BMP. A detailed source survey of both in-channel and road-related sources of sediment was conducted for the entire South Fork of Lost Creek watershed. Road-related sediment sources are listed in the project file.

Other potential or existing sources of sediment include three bridges across the South Fork of Lost Creek. One present source of sediment is a failing bridge located in section three on Forest Service ownership. The structure is wooden with back filled wooden abutments. This bridge has been overtopped by stream flow numerous times in the past decade or so. The fill behind the abutments has begun to erode on the south side of the creek, and all of the decking has come off. This bridge will continue to contribute sediment to the South Fork of Lost Creek on a nearly annual basis during high runoff until it is either washed out completely or removed and the site rehabilitated.

The other two decaying bridges are potential sources of sediment located in Sections 2 and 4 on State land. These bridges were built at the same time as the bridge on Forest Service land but were built with more freeboard, so they have not been overtopped. The construction is the same as the failed bridge, and the fill around the abutments is in danger of erosion during higher than normal runoff. These bridges present a moderate risk of failure and sedimentation to the creek.

B. Cumulative Watershed Effects

Cumulative watershed impacts are defined as impacts that may result from the proposed action when combined with other past and present actions. Individually, these actions may not adversely affect water quality, but when combined present a higher risk of adverse impacts. Timber harvest and associated activities affect the timing, distribution, and amount of water yield in a watershed. Water yields increase in proportion to the percentage of canopy removal because removal of live trees reduces the amount of water transpired, leaving more water available for soil saturation and runoff. Canopy removal also decreases interception of rain and snow, and alters snowpack distribution and snowmelt, which lead to further water yield increases. Higher water yields may lead to increases in peak flows and peak flow duration, which result in accelerated streambank erosion and subsequent deposition of fine sediment.

1. Current Conditions

Land use history within the proposed project area includes commercial timber harvest and recreation activities. DNRC has conducted timber sales in the South Fork Lost Creek watershed since 1962. The Flathead National Forest (FNF) also harvested some of its land within the South Fork of Lost Creek watershed beginning in the 1950s, and has harvested as recently as 1982. Avalanches have removed the mature forest vegetation on several hundred acres in the project area. Although new forest growth is occur-

ring in these areas, the avalanche chutes probably would never become fully forested due to recurring avalanches.

A DNRC hydrologist gathered channel stability data in 1995 in accordance with procedures outlined in Forest Hydrology Part II (USFS 1976). Stream bank stability ranged from fair to good on all reaches reviewed. Most areas of instability were a result of debris jams caused by avalanches. Avalanches carry large amounts of sediment and very high levels of large woody debris to the creek. These jams lead to instability and sediment delivery because they can accumulate relatively small diameter material which can be detached by high runoff. The other reaches where channel stability was rated as fair were due to the South Fork Lost Creek road encroaching on the banks and riparian area of the creek. These channel stability assessments are used to determine the stream's capacity to handle increases in annual runoff, in accordance with procedures outlined in Forest Hydrology Part II.

DNRC's hydrologist estimated that channel stability and water quality in the South Fork of Lost Creek might begin to be adversely affected if water yield were to increase 10 percent above the projected baseline. This "threshold of concern" was arrived at through analysis of the channel stability assessments, adherence to the guidelines for watershed management in the Swan River State Forest Management Plan (1978), and direction from the SFLMP to manage at low risk for watershed impacts in all tributaries to the Swan River.

2. METHODOLOGY

The cumulative effects of past activities in the South Fork of Lost Creek watershed were determined using the PC version of the R1WATSED model developed by Region 1 of the U.S. Forest Service. WATSED estimates the increase in water yield caused by removal of live trees using the Equivalent Clearcut Area (ECA) method. As live trees are removed, the water they would have evaporated and transpired either saturates the soil, or is translated to runoff. This method also calculates the recovery of these increases as new trees vegetate the site and move toward pre-harvest water use. WATSED also estimates sediment production from road and timber harvest activities. Estimates of sediment production by activities are expressed as a percentage above an estimated "natural" baseline condition generated by the model based on soil types and watershed size. Since the natural conditions are calculated based on empirical formulas and not site specific measured data, sediment values generated by the model are only valid as a comparison between alternatives and should not be interpreted as absolute values.

3. RESULTS

According to WATSED, the present annual water yield increase is 1 percent over natural, the peak flow increase is 1 percent over natural, and past timber harvesting has generated approximately 325 ECA.

VII. FISHERIES

Westslope cutthroat trout and bull trout are species of special concern found in limited numbers and habitats in Montana. The Montana Department of Fish, Wildlife and Parks (DFWP) manages the Swan Drainage for the native westslope cutthroat trout and bull trout. In order to meet the recommendations for these species from the Flathead Basin Forest Practices, Water Quality and Fisheries Cooperative Program (the cooperative study report of the Flathead Basin Commission 1991), DNRC has

contracted DFWP and arranged for the collection efforts required to develop index values of existing habitat quality as recommended. The DNRC/DFWP strategy is to first develop the index of juvenile bull trout rearing habitat quality using substrate scoring and McNeil coring as described in the cooperative study report. Based on the results from substrate scoring, DNRC in consultation with DFWP would determine if additional monitoring is necessary.

A. Swan River

Bull trout and migratory westslope cutthroat trout inhabit Swan Lake and Swan River, and use small Swan River tributaries for spawning and rearing of juveniles. Because of this migratory behavior, the effects of the proposed timber harvesting on the South Fork of Lost Creek and downstream waters must be considered.

The presence of bull trout and cutthroat trout in the Swan River and the South Fork of Lost Creek indicate that mitigating measures, including the Immediate Actions for Bull Trout Recovery agreed to by DNRC and the Governor's Bull Trout Restoration Team in 1994 (Montana DNRC 1994), should be implemented on all streams affected by the proposal.

B. South Fork Lost Creek

In July of 1994, Tom Weaver, a fisheries biologist from DFWP, began gathering baseline data for the watershed. Data were obtained through species composition surveys, spawning surveys, and substrate scoring on the South Fork of Lost Creek. Evidence of both westslope cutthroat and bull trout was found. Spawning surveys, substrate scores and McNeil core sites have been monitored annually since 1994 with the results to date reported in table 3-18.

Table 3-18. Summary of fisheries monitoring data in the South Fork Lost Creek

Parameter	FY 1994	FY 1995	FY 1996
Westslope Cutthroat Redds	7	12	19
Bull Trout Redds	9	19	28
Substrate Score	11.7 (7/94)	11.7 (7/95)	11.6 (7/96)
McNeil Core	30.4 (3/95)	28.8 (3/96)	23.4 (3/97)

The Flathead Basin Forest Practice Study showed a direct link between on-the-ground activity (as indicated by the Sequoia Index) and habitat quality (determined by McNeil coring). The study showed an even stronger tie between the quality of spawning habitat (indicated by the percentage of fines) and the survival of embryos to emergence. The cooperative recommended a cautious approach to management when the amount of fine material (6.35 mm or smaller) as indicated by McNeil coring exceeds 35 percent. The FY 1996 McNeil coring sample for the South Fork of Lost Creek showed the fine material (6.35mm or smaller) at 23.4 percent. The decreased fines and increased number of trout redds indicated in the table suggest that spawning habitat has improved, at least in the short term, perhaps as a result of high flushing flows generated by runoff from heavy snowpack in recent years.

VIII. AIR QUALITY

The project area is within Montana Airshed 2 (Kalispell) and is not in a sensitive impact zone (USFS 1992). Air quality within this airshed is considered good. Temporary reductions in air quality occur primarily during wildfires and burning of logging residue. The airshed is managed by the Montana Airshed Group which monitors weather conditions and imposes burning restrictions when dispersion and ventilation are poor.

IX. VISUAL QUALITY

The project area is visible from boats on the south end of Swan Lake, from forest roads on the western flank of the Swan valley, and from the South Fork Lost Creek road. The project area cannot be seen from residences, Highway 83, Point Pleasant Campground, or Soup Creek Campground, because of topography and the dense forest in the Swan valley.

The aesthetic characteristics of the project area from all three of these viewpoints have been altered by land management activities over the past 35 years. Timber harvest and road construction have been a part of this environment since the early 1960s, with the most recent harvest activities occurring in the 1980s. Previous harvest units in the project area are regenerated with trees in age up to 20-30 years and reaching heights up to 40 feet. Some of these units also retain large, mature seed trees.

A. View from Swan Lake and the western flank

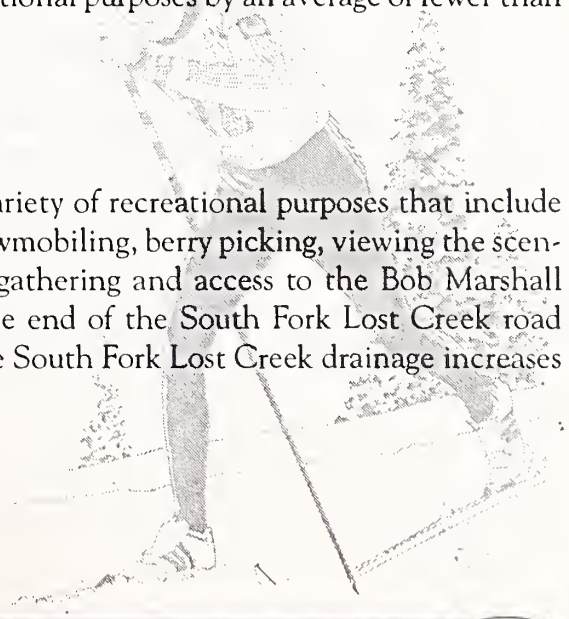
The portion of the project area that can be seen from the south end of Swan Lake and the western shore is approximately 4.5 miles from the lake and consists mainly of mature stands of timber. Two units that were harvested in the 1960s and 1970s also can be seen from this view point. These stands are fully stocked primarily with 20-30 year old larch saplings. The contrasting colors are most notable in the fall when the larch turn a golden yellow. Swan Lake is a popular recreation site, with peak use during the summer months.

B. View from South Fork Lost Creek Road

South Fork Lost Creek road extends approximately 4 miles through the project area. The road provides a view of canyon walls rising above, the creek below, and dense timber, rock outcrops, avalanche chutes, riparian areas and a variety of habitat types. Constructed primarily for hauling timber, this road currently is used for recreational purposes by an average of fewer than 20 vehicles per week.

X. RECREATION

The South Fork Lost Creek watershed area is used for a variety of recreational purposes that include hunting, fishing, camping, hiking, cross country skiing, snowmobiling, berry picking, viewing the scenery, and wildlife watching. Other use includes firewood gathering and access to the Bob Marshall Wilderness via trail 98. The trailhead of trail 98 is at the end of the South Fork Lost Creek road approximately 9 miles from Highway 83. Recreation in the South Fork Lost Creek drainage increases every year.



CHAPTER 4

ENVIRONMENTAL CONSEQUENCES

I. INTRODUCTION

This chapter describes the environmental effects of each alternative on the resources described in Chapter 3, and provides the basis for the summary of environmental effects table in Chapter 2. An economic analysis also is presented. Included at the end of the chapter is a list of proposed mitigation common to all of the timber harvest alternatives.

A. PROJECTS UNDER CONCURRENT CONSIDERATION

The cumulative effects of past activities are discussed in Chapter 3. The related projects under concurrent consideration in the Swan River State Forest (SRSF) are the Middle Soup timber sale (DNRC 1997) and the Cilly Creek proposed timber sale. The Middle Soup timber sale has been included in the cumulative effects analysis for the proposed South Fork Lost Creek timber sale.

As of September, 1997, the proposed Cilly Creek timber sale was in the initial stages of development. DNRC solicited public participation in the Cilly Creek project in March 1997 by distributing a project proposal to interested individuals, landowners, organizations, industries and agencies. The scoping process lasted for 30 days. The interdisciplinary team is in the process of reviewing the comments received by the public. As of September, 1997, the following sections of T24N, R17W were being considered for inclusion in the Cilly Creek project: 9, 10, 11, 14, 15 and 22. After alternatives for the Cilly Creek project are developed, an effects assessment will be conducted as part of that EIS. This assessment will include a quantitative assessment of potential cumulative effects, including the effects of the South Fork Lost Creek project.

II. FOREST CONDITIONS

The analysis of the affected environment in Chapter 3 indicates that the forests of the SRSF and the South Fork Lost Creek project area are dominated by shade-tolerant tree species to a far greater extent than would occur under average historical conditions. The data also indicate that both SRSF and the South Fork Lost Creek project area contain old forests in greater abundance than the historical average and greater than the retention commitments stated in the DNRC State Forest Land Management Plan (SFLMP). The forest also exists in smaller patches than historically. Vigor of stands within the project area is approximately equally split between fair-to-good and fair-to-poor.

This effects analysis focuses on the extent to which the various alternatives would move the forest toward historical conditions and SFLMP commitments, and improve the vigor of the forest.

A. Effects on Stand Age, Cover Type and Vigor

1. Cover Type Representation

a) Effects of Alternatives A, B, C and D

Alternative D would provide the greatest movement toward desired future conditions by converting 411 acres of shade-tolerant species; followed by Alternative C which would reduce shade-tolerants by 405 acres; Alternative B would convert only 222 acres to shade-intolerant species types.

Chapter 3 describes the transition of cover types, through succession from domination by shade-intolerant tree species to shade-tolerants, especially from western larch/Douglas-fir into mixed conifer types. In the 1930s, 84 percent of the SRSF was dominated by shade-intolerant species compared to the present 38 percent. Thus, to move toward historic conditions some stands would have to be converted back to shade-intolerants. The total change in the SRSF as a result of harvesting in one drainage such as the South Fork of Lost Creek would be negligible.

With Alternative A, the cover type representation would continue to shift toward shade-tolerant tree species. There also would be an increased risk of stand replacement fire, and increased susceptibility to insects and disease. The shift would continue on a trajectory of non-sustainability.

Each timber harvest alternative would increase the amount of shade-intolerant species within treated stands, though the magnitude would be small. Alternatives C and D would change the proportional cover type representation on the SRSF, increasing the western larch/Douglas-fir type by 1 percent and decreasing the mixed conifer type by 1 percent. Both of these movements are in the direction of desired future conditions.

Alternative D would provide the greatest movement toward historical conditions by converting 411 acres of shade-tolerant species; followed by Alternative C which would reduce shade-tolerants by 405 acres; Alternative B would convert only 222 acres to shade-intolerant species types.

2. Age Class Distribution and Old Stands

a) Effects of Alternatives A, B, C and D

Under Alternative A, forests would continue to age, increasing multi-story conditions, insect and disease susceptibility, and the risk of catastrophic fires. Over time, the existing old stands would begin to lose many of the qualities generally associated with age, such as large trees. Other qualities would increase, such as decadence, snags and down coarse woody debris.

Post treatment ages of stands were calculated as follows: light-reserve or moderate-reserve treatment would reduce age to zero; a heavy-reserve or structural enhancement treatment would not change stand age. Stands treated with heavy-

reserve and structural enhancement would remain sawtimber class stands. Cover type might change, because the treatments are focused primarily on removal of shade-tolerant tree species and enhancing the growing space of large shade-intolerant species.

None of the timber harvest alternatives would have any major effect on overall age class distribution on the SRSF. Alternative B would reduce old stand acreage by 76 acres; Alternative C by 74 acres; and Alternative D by 135 acres. Alternative D would cause the greatest movement toward historical conditions, although its overall effect on proportions of old stands on the SRSF would be minor.

Within the project area, old stands would be reduced from 2,387 acres (or 59 percent) to 2,311 acres (56 percent) by Alternative B, 2,312 acres (56 percent) by Alternative C, and 2,263 acres (54 percent) by Alternative D. All of these reductions would retain old stands in proportions over the historical average and well over SFLMP commitments. Alternative D would move the project area closest to a long term average, or appropriate condition.

3. Replacement Old Stands

a) Effects of Alternatives A, B, C and D

Alternative A would not improve the health of the forest or lead toward the development of replacement old stands. The SFLMP is committed to maintain or restore at least half the historical proportion of old growth expected to occur with natural processes, and to retain sufficient acres of old stands. Only the western larch/Douglas-fir type is currently short of replacement acres in the 110- to 150-year age classes with 6 percent of the project area occupied by this type, compared to the historical presence of 10 percent. Alternative D would raise the representation to 7 percent, and alternatives B and C would have no effect. Further, cover type conversion would increase old western larch/Douglas-fir by 5 acres under Alternative B, 58 acres under Alternative C, and 114 acres under Alternative D.

4. Stand Vigor

a) Effects of Alternatives A, B, C and D

Stand vigor would continue to deteriorate under Alternative A as increased regeneration of shade-tolerant trees would crowd out more vigorous shade-intolerant species. Each timber harvest alternative would increase vigor--Alternative D the most.

TABLE 4-1. STAND VIGOR RATINGS AND EFFECTS OF EACH ALTERNATIVE (IN ACRES).

	Alternatives			
Vigor Class	A	B	C	D
Full vigor	139	641	752	415
Good to Fair	2,488	2,261	1,962	2,658
Fair to Poor	1,198	1,018	1,122	933
Very Poor	206	109	195	24
AVERAGE VIGOR RATING*	2.36	2.15	2.19	2.14

*Average vigor rating is obtained by multiplying acres in vigor classes by 1 for the full vigor class, 2 for the good vigor class, 3 for fair, and 4 for very poor; then dividing by total acres.

5. PATCH SIZES BY COVER TYPE

A) EFFECTS OF ALTERNATIVES A, B, C AND D

None of the alternatives would have a profound effect on increasing or decreasing cover type patch sizes for the entire SRSF. Over time, Alternative A would result in increased patch size with little differentiation among stands. Timber harvest alternatives would decrease patch size by about 7 acres in the white pine type and 26 acres in mixed conifer types. Harvesting would slightly increase patch size in the subalpine, western larch/Douglas fir and Douglas-fir types, with increases ranging from 1.6 to 2.1 acres per patch. Within the project area, effects on patch sizes would be more pronounced. The effects are shown in Table 4-2 below. Alternative B would have the least effect on reducing patch size while alternatives C and D would have the most effect.

TABLE 4-2. EFFECTS OF ALTERNATIVES ON AVERAGE PATCH SIZE IN THE PROJECT AREA (ACRES).

	Alternatives			
Cover Type	A*	B	C	D
Ponderosa pine	12	0	0	0
Douglas-fir	10	+17	+6	+9
Western larch / Douglas-fir	30	+11	+18	+11
White pine	119	-39	-42	-27
Lodgepole pine	na			
Mixed conifer	279	-111	-73	-94
Subalpine types	144	+20	+44	+40
AVERAGE	110	-21	-25	-25

* A is the present average patch size in acres. Plus and minus symbols signify change in acreage from the present.

6. Patch sizes by Age Class

a) Effects of Alternatives A, B, C and D

For the entire SRSF, effects of harvesting on patches of old stands are more noticeable than effects on cover type patches. Over time, Alternative A would increase patch size by age class, but would reduce diversity. Alternative B would reduce the average old stand patch size on the SRSF from 211 acres per patch to 192 acres; Alternative C to 202 acres and Alternative D to 199 acres.

Effects on average patch size in the project area would be fairly uniform among timber harvest alternatives except for the old stand age class. In old stands, the existing average patch size of 298 acres would be reduced by Alternative B to 153 acres, by Alternative C to 238 acres and by Alternative D to 163 acres. Although Alternative C would avoid harvesting old stands with old growth characteristics, some of the units harvested would be old. Alternative B would reduce old stands patch size the most, but overall would have the smallest effect on patch size by age class.

Table 4-3. Effects of the Alternatives on Patch Size for Each Age Class in the Project Area.*

	Alternatives			
Age Class	A	B	C	D
0-39	38	+33	+9	+12
40-100	103	+0	-68	+0
100- old stands	53	-7	+4	+3
old stands	298	-145	-61	-135
Average	95	-6	-13	-10

*Alternative A shows present patch size in acres. Plus and minus symbols signify change from the present condition.

7. Patch Shape Changes for Each Cover Type

a) Effects of Alternatives A, B, C and D

Alternative A would decrease the complexity of patch shape for each cover type due to the homogenization of cover types and the reduction of diversity. Effects on patch shape of equivalent cover types would be small.

Each timber harvest alternative would reduce the complexity of patch shape within the SRSF and the project area, especially Alternatives B and D. Patch shape index for alternative A would be 1.48, 1.42 for Alternative B, 1.46 for Alternative C, and 1.43 for Alternative D. The lower the number , the less complex the shape. Reducing patch shape complexity probably would move the forest toward historical conditions.

8. Patch Shape Changes for Each Age Class

a) Effects of Alternatives A, B, C and D

Over time, Alternative A would decrease patch shape complexity due to the homogenization of age classes in old-age stands. Effects on patch shape of various age classes also would be small.

Alternative B would decrease the complexity of old stand patches; Alternative C would slightly increase complexity, and Alternative D would reduce complexity substantially. Reducing patch shape complexity of old stands probably would move the forest toward historical conditions. Alternatives B and D would both reduce complexity, with Alternative B providing the greatest reduction.

B. Summary of Effects on Forest Conditions

Overall effects to the SRSF would be small. Alternative D would cause the greatest movement in the desired direction for the most characteristics, i.e., cover type representation, age class distribution, vigor and patch shape of old stands. Alternative C would have an intermediate effect on moving the forest in the desired future direction for cover type representation, patch size and patch shape, while maintaining the largest old stand patch size. Alternative B would do the least of the timber harvest alternatives to move the forest in the desired future direction for cover type representation, patch size and patch shape, but would do the most for patch size and patch shape. Alternative A would move the forest further from historic conditions and would not move the forest in the desired future direction as indicated by the SFLMP.

III. SOIL

Timber harvesting activities have the potential to rut, compact, and displace soil. These impacts can lead to poor timber regeneration, loss of productivity, and erosion. Susceptibility to these impacts is affected primarily by soil type and slope.

Several precautions would be taken to reduce soil impacts from skidding and mechanical site preparation. Harvesting would be conducted when soil is dry, frozen, or snow covered. Skid trails would be planned in advance by the sale administrator, and existing trails would be used where practical. Trackhoe excavators would be used to pile brush and scarify soil. Excavators have greater flexibility



Photo 6- Access road and rocky cliffs above the South Fork Lost Creek.

and damage soils less than brush dozers. Excavator piling and scarification would be limited to less than 40 percent of the area in cutting units. Skid trails would not cover more than 20 percent of the surface in any cutting unit. Woody debris would be retained to promote long term soil stability and productivity.

No permanent adverse effects to soil would result if these conditions are followed, along with all applicable Best Management Practices , and the recommendations of the hydrologist. Impacts to soil productivity from any timber-harvest alterntive would be well within the BMP standard of 15 percent or less of the harvested area in skid trails and landings. The following is a summary of the anticipated effects of each proposed alternative.

A. Effects of Alternative A

Alternative A would have no direct effects to soil stability or productivity. This alternative might indirectly increase in soil erosion in the proposed project area on the existing road system. Under this alternative, none of the proposed road improvements or relocations would be completed. These problems would continue under natural or preexisting conditions until funding is available for repairs. Sedimentation is discussed in the Water Quality section of this document.

B. Effects of Alternative B

This alternative would harvest approximately 615 acres. About 125 of these acres would be harvested with a low ground pressure soft track skidder, and 151 with a conventional tractor. Skidding with ground-based equipment can damage up to 20 percent of the area harvested (the effects of yarding with a low ground pressure skidder are approximately half those of conventional tractors), with severe damage (requiring 30 to 40 years to be revegetated) on up to 10 percent of the damaged area. Further, 287 acres of the harvest site would be prepared for regeneration with a track-hoe excavator to pile slash and scarify soil. Mechanical preparation of harvested sites for regeneration can compact or displace soil on up to 15 percent of the surface, depending on the type of machinery used.

Alternative B would generate approximately 55 acres of skid trails, of which about 5 acres would be severely damaged. Mechanical preparation of the site for regeneration would cause soil compaction or displacement on about 43 acres.The total 48 acres of soil damage would equal roughly 8 percent of the proposed cutting unit acreage.

C. Effects of Alternative C

This alternative would harvest timber on approximately 668 acres, 148 of them with ground-based equipment. Conventional ground-based machinery would be used on 79 of these acres, with a low ground pressure skidder used on 69 acres. Approximately 119 acres would be prepared for regeneration by mechanical means, which would cause compaction or displacement on up to 36 acres.

These proposed activities would leave approximately 30 acres of the harvest units in skid trails, with about 3 acres severely damaged (requiring 30 to 40 years to revegetate.) The total 39 acres of surface damage would be roughly 6 percent of the harvested area.

D. Effects of Alternative D

This alternative would harvest approximately 695 acres, approximately 545 of them with ground-based equipment. About 120 of these acres would be harvested with a low ground-pressure skidder, and the remaining 425 with a conventional tractor. These proposed activities would leave approximately 109 acres of the harvest units in skid trails, with severe damage (requiring 30 to 40 years to revegetate) to about 10 acres. Mechanical site preparation would be used on about 414 acres, with severe damage to 62 acres. The total 72 acres that would be damaged under Alternative D would be roughly 11 percent of the harvested area.

IV. WILDLIFE

A. Threatened and Endangered Species

1. Grizzly Bear

a) Harvest Operations

Eleven Bear Management Subunits have been designated in the Swan Valley Grizzly Bear Conservation Agreement (USFWS 1995b). These subunits are watershed-based, averaging about 50 square miles, and include spring, summer, and fall grizzly bear habitat.

The parties to the SVGBCA have agreed to limit their commercial operations by concentrating and rotating harvests through the subunits in the conservation area, leaving 7 of the 11 subunits inactive at any given time for periods of at least 3 consecutive years. This rotating harvest schedule is designed to reduce the potential for commercial harvesting activities to disrupt and disturb grizzly bears.

The Middle Soup Creek Project Area, the South Fork Lost Creek Project Area and the Cilly Creek Project Area are all located within the South Fork Lost Soup Subunit (Figure 3-2). Under SVGBCA, harvest activity is permitted in the South Fork Lost Soup Subunit from 1997 until April 15, 2000.

b) Security Cover

SVGBCA specifies that adequate hiding cover be maintained for grizzly bears throughout each Bear Management Subunit. Additionally, visual screening will be maintained along open roads and between roads and even-age harvest units to reduce line-of-sight distances and provide more security for grizzly bears.

C) Linkage Zones

Four "linkage zones" to provide movement corridors for grizzly bears crossing the Swan valley are recognized in SVGBCA. The primary purpose of these linkage zones is to provide secure, low elevation spring grizzly bear feeding areas and to prevent isolation of the Mission Mountains grizzly bear population. Riparian habitat preferred by grizzly bears in linkage zones will be protected through intensive road management (described below) and seasonal operating restrictions.

D) Road Management

In order to minimize risks to grizzly bears from human-bear interactions, Plum Creek, DNRC and USFS have agreed to work cooperatively to limit motorized access in the Swan Valley Conservation Area (as defined in the SVGBCA). Major public travel routes and roads to private residences will not be affected by this agreement. USFS will not increase total road density on its ownership and all parties to the agreement will cooperate in identifying roads on their lands which are unnecessary for management and can be closed to all uses during the spring, summer and fall.

E) SVGBCA Provisions

The following standards and guidelines from the Swan Valley Grizzly Bear Conservation Agreement are incorporated into all alternatives:

- Any commercial timber harvest that would occur under any of the timber-harvest alternatives would be scheduled for completion by April 15, 2000.
- Visual screening would be retained between open and restricted roads and cutting units with light or moderate-reserve harvest, except as necessary to accommodate cable yarding.
- No point in any light or moderate-reserve harvest unit could be more than 600 feet from cover.
- Light or moderate-reserve harvest units adjacent to an open road cannot exceed 1 acre.
- Only uneven-aged harvest prescriptions may be used where timber is harvested in riparian zones.
- All owners will manage their land to maintain a minimum of 40 percent of each BMU subunit in cover.

Compliance of each alternative with SVGBCA standards, guidelines, and recommendations is discussed below.

F) Open Road Density

Effects of Alternative A

Under Alternative A, the existing road system would remain as is; no currently open roads would be restricted, no currently restricted roads would be opened, and the existing road along South Fork Lost Creek would remain the

same. The percentage of the South Fork Lost Soup BMU Subunit with an open road density greater than 1 mile per square mile would remain the same as at present (28 percent for all ownerships and 34 percent for DNRC ownership).

Effects of Alternatives B, C, and D

For all three timber harvest alternatives, approximately 1.3 miles of the existing road that parallels the South Fork of Lost Creek would be closed and replaced with approximately 1.7 miles of new road approximately 500 feet upslope. The percentage of the South Fork Lost Soup BMU Subunit with an open road density greater than 1.0 mile per square mile would remain 28 percent for all ownerships and 34 percent for the DNRC portion of the subunit.

G) TOTAL ROAD DENSITY

As a state agency and a private company, DNRC and Plum Creek Timber Co. are not subject to SVGBCA total road density standards. Monitoring of this variable, however, assists the Forest Service which is accountable for total road density on its land under the SVGBCA. Using the moving windows method, total road density is expressed as the percentage of an area with a total road density of at least 2.0 miles per square mile.

Effects of Alternative A

Total road density would remain the same as the existing condition with a total road density of at least 2.0 miles per square mile on 45 percent of the entire South Fork Lost Soup BMU Subunit, on 54 percent of DNRC lands within the subunit, and on 29 percent of USFS land in the subunit.

Effects of Alternative B

Alternative B would increase the total road density from 45 percent to 47 percent for the entire subunit, from 54 percent to 56 percent on DNRC land within the subunit, and from 29 percent to 30 percent for USFS land in the subunit.

Effects of Alternative C

Alternative C would increase the total road density from 45 percent to 47 percent for the entire subunit, from 54 percent to 56 percent for DNRC land within the subunit, and from 29 percent to 31 percent for USFS land in the subunit.

Effects of Alternative D

Alternative D would increase the total road density from 45 percent to 47 percent for the entire subunit, from 54 percent to 55 percent for DNRC land within the subunit, and from 29 percent to 31 percent for USFS land in the subunit.

H) Hiding Cover

Effects of Alternative A

Alternative A would retain the existing 79 percent hiding cover currently estimated within the South Fork Lost Soup BMU Subunit. Ninety-one percent of the DNRC portion of the subunit would continue to provide hiding cover.

Effects of Alternative B

This alternative would include light or moderate-reserve harvest of 492 acres. Hiding cover would be reduced from 79 percent to 77 percent for the entire subunit and from 91 percent to 88 percent for the DNRC portion of the subunit, both well within compliance of SVGBCA's 40 percent hiding cover standard.

Effects of Alternative C

This alternative would include harvest of 454 acres through light or moderate-reserve treatments. Hiding cover would be reduced from 79 percent to 77 percent for the entire subunit and from 91 percent to 89 percent for the DNRC portion of the subunit.

Effects of Alternative D

This alternative would include 277 acres of light or moderate-reserve harvest. Hiding cover would be reduced from 79 percent to 78 percent for the entire subunit and from 91 percent to 89 percent for the DNRC portion of the subunit.

I) Core Area

DNRC and Plum Creek Timber Co. are not subject to SVGBCA core area standards although they may voluntarily contribute core. DNRC monitoring of core area percentage in the Swan Valley Conservation Area BMU subunits helps USFS meet its SVGBCA obligations. Besides the spatial definition of core area (at least 2,500 contiguous acres at least 0.3 miles from motorized access routes), core areas should remain intact for at least 10 years (IGBC 1994. However, the following discussion of alternatives only compares the effect of each alternative on land that meets the spatial definition of core area.

Effects of Alternative A

Under the no-action alternative, 38 percent of the South Fork Lost Soups BMU Subunit would continue to meet the spatial definition of core area. Twenty-eight percent of the DNRC land in the subunit would qualify as core area.

Effects of Alternative B

Alternative B would meet the spatial definition of core area on 36 percent of the subunit and 25 percent of DNRC land in the subunit.

Effects of Alternative C

Alternative C would meet the spatial definition of core area on 36 percent of the subunit, and 24 percent of DNRC land in the subunit.

Effects of Alternative D

Alternative D would meet the spatial definition of core area on 37 percent of the subunit and 27 percent of DNRC land in the subunit.

J) Cumulative Effects

Recent, present, and proposed actions in the South Fork Lost Soup BMU Subunit include DNRC's Middle Soup timber sale and proposed Cilly Creek timber sale. Both timber sales are scheduled for harvest during the Active Period designated by SVGBCA for the South Fork Lost Soup Subunit (USFWS 1995b, Attach. I).

Analyses and mitigation measures for the Middle Soup timber sale were completed prior to the effective date of the SVGBCA. Nevertheless, the Middle Soup timber sale complies with all of the guidance recommended in the SVGBCA and no detrimental cumulative effects are expected.

Alternatives have not been identified for the Cilly Creek timber sale. DNRC is committed to designing all alternatives to comply with the SVGBCA. However, cumulative impacts to grizzly bear habitat on other ownerships in the South Fork Lost Soup BMU Subunit could result from the building of new roads or opening of currently restricted or obliterated roads under the proposed Cilly Creek timber sale. These effects cannot be quantified before alternatives are defined.

2. Wolf

A) Effects of Alternatives A, B, C and D

The South Fork of Lost Creek drainage is a narrow, steep-sided valley with numerous rock outcrops. Most of the project area has a northerly aspect and, in winter, supports a low-density of mule deer, elk and moose. Low prey densities throughout the year and topography difficult for a wolf to hunt make the project area unlikely to be important to wolves. None of the alternatives would diminish the area's suitability for wolves.

3. Bald Eagle

a) Effects of Alternatives A, B, C and D

Management objectives for eagle foraging habitat include the regulation of poisons and chemicals, maintenance of water quality and populations of prey species, and elimination of electrocution hazards (USFWS 1986, Montana Bald Eagle Working Group 1994). No poisons or electrocution hazards would be introduced into the area as a result of the proposed action (and none exist there now). The herbicides picloram and 2, 4-D would be used to control noxious weeds along roads. Neither herbicide is likely to pose a threat to bald eagles if applied at doses recommended by the manufacturer. There is no potential bald eagle foraging habitat in the project area and the bald eagle prey base would not be affected. Bald eagles are not likely to be affected.

4. Peregrine Falcon

a) Effects of Alternatives A, B, C and D

Foraging opportunities for peregrine falcon exist along Swan River, approximately 4 miles west of the project area, and at Swan Lake, 4 miles northwest. These areas would not be affected by the proposed action.

Timber harvesting is not likely to affect any peregrine falcon nesting sites. Peregrine falcons typically nest on cliff ledges, rock outcrops, or talus slopes. Preferred nest sites overlook meadows and riparian habitat. The project area and the surrounding vicinity include rocky outcrops and talus slopes, but these are surrounded by heavy timber, do not overlook meadows or riparian habitat, and are snow-covered late into the peregrine falcon breeding season, making them less than desirable nesting sites. Peregrine falcons return to the same nest site year after year and do not readily colonize new areas. Peregrine falcons have been sighted in Swan valley during spring and fall migration. Timber harvesting would not impede migratory movements and mortality risk would not increase due to proposed timber harvest.

B. Sensitive Species

1. Black-backed Woodpecker

a) Effects of Alternatives A, B, C and D

There are no recent burns in the project area to provide optimal habitat for black-backed woodpeckers, although some relatively minor foraging use may occur. However, any reduction in the probability of future fires constitutes an indirect impact on black-backed woodpeckers because they appear to be tied to flushes in insect prey that are associated with recent burns. Any alternative that would reduce the probability of a crown fire would have an indirect impact on black-backed woodpeckers.

Under Alternative A, no timber would be harvested and most of the drainage would retain the possibility of a crown fire with consequent development of black-backed woodpecker habitat. The probability of intense fire would re-

main steady or increase with time as fuel loads increase. All timber harvest alternatives propose to harvest mature and old stands of timber. Converting these mature timber stands to early successional stages could affect potential black-backed woodpecker habitat in two ways: (1) Areas harvested with light- or moderate-reserve treatments would retain two to six live trees per acre, with little potential to produce fire-killed snags and the insect prey associated with snags. Acres of mature timber that would be harvested using either of these methods, are: Alternative B: 509 acres; Alternative C: 458 acres; Alternative D: 305 acres; and (2) In contrast to mature forest, early successional areas have little fire fuel and present a barrier to the spread of fire, which would reduce the probability or size of large stand-replacement fires. Many unpredictable factors affect the probability of fire start and spread, such as moisture, wind, placement of lightning strikes, and the interaction among these. Many scenarios are thus possible, precluding a meaningful assessment on the relative effect of the timber harvest alternatives on probability of fire start and spread.

2. Western Big-eared Bat

a) Effects of Alternatives A, B, C and D

The only areas in the project area that might have the potential to support communal roost sites are the rocky outcrops in sections 2 and 3. No harvest would take place on or near these outcrops under any alternative, and communal roost sites probably would not be affected. Under Alternative A, no trees would be harvested and any scattered individual trees that may provide roost sites for bats roosting individually would remain. Under all timber harvest alternatives, some scattered large individual trees that might provide sites for bats roosting individually would be harvested. Because the acreage and timber volumes involved do not differ greatly among the alternatives (615-695 acres, and 9,491-9,981 MMBF), and because it is not possible to know exactly how many potential roost trees would be harvested in each alternative, it is not possible to assess the relative impact of the different alternatives on western big-eared bats. Impacts are expected to be minimal, however, because trees are only occasionally used for roosting, and roost tree availability is not considered to be a limiting factor on populations.

3. Boreal Owl

a) Effects of Alternatives A, B, C and D

No areas categorized under the SLI as boreal owl habitat would be harvested under alternatives A or C. Habitat availability and quality would remain high. Under alternatives B and D, some areas categorized as potential boreal owl habitat would be harvested with either the light or moderate-reserve_treatments, which would leave four to eight live trees per acre after harvest. Because boreal owls prefer structurally complex mature spruce-fir forest with high densities of large trees, it can be assumed that either treatment would render these areas unsuitable as boreal owl habitat. Both alternatives B and D would harvest the same 46 acre patch of medium quality habitat, and alternative D would harvest an additional 67 acres of high quality habitat (Table 4-4 below and Figure 3-3 in Chapter 3). The percentages this represents of the total

amount of medium and high quality habitat on both the project area and the SRSF are shown in table 4-4.

TABLE 4-4. CHANGES IN THE AMOUNT OF BOREAL OWL HABITAT FOR EACH ALTERNATIVE, ON BOTH THE PROJECT AREA AND THE SRSF. THERE ARE CURRENTLY 1,373 ACRES OF BOREAL OWL HABITAT IDENTIFIED WITHIN THE SRSF. 247 OF THESE ACRES ARE LOCATED WITHIN THE PROJECT AREA. OF THESE 247 ACRES, 201 ACRES ARE HIGH QUALITY AND 46 ACRES ARE MEDIUM QUALITY.

Parameter	Alternatives A and C amount of habitat harvested	Alternative B amount of habitat harvested			Alternative D amount of habitat harvested		
	total amount habitat	high quality habitat	medium quality habitat	total habitat	high quality habitat	medium quality habitat	total habitat
acres harvested	0	0	46 ac	46 ac	67 ac	46 ac	113 ac
percent of boreal owl habitat proposed for harvest in the project area	0	0	100 %	19 %	33%	100%	46%
percent of boreal owl habitat proposed for harvest on SRSF under the proposed project	0	0	5.9%	3.3%	11.3%	5.9%	8.2%

* high quality boreal owl habitat consists of stands that have some live ponderosa pine or larch, which indicates a higher probability that snags of these species (used for nesting) are present in the stand. Medium-quality stands do not have these live tree species present, although snags may be present.

Reducing the total amount of available habitat would affect boreal owls mostly by reducing their food base. Boreal owl nesting success and population density are thought to be limited by food availability (Hayward 1994), and reducing the amount of foraging habitat could have substantial consequences for any boreal owls using this area (Hayward 1997). Alternative D would harvest almost half of the boreal owl habitat in this watershed, while alternative B would harvest about one-fifth. Reducing the available habitat by half could reduce habitat suitability from being able to support 3-4 breeding pairs (boreal owls are not territorial and home ranges overlap), to unable to support any breeding pairs (Hayward 1997), depending on how populations of red-backed voles and other prey species respond. It is impossible to say what effect this would have on regional boreal owl populations (Hayward 1997).

The magnitude of effect would depend on the amount and proximity of other available foraging habitat. Maximum recorded nightly travel distances between boreal owl nests and foraging areas range from about .6 - .8 miles (Hayward 1994). The next closest patches characterized as boreal owl habitat

are about 1.5 and 2.5 miles to the south, which are probably too far for nesting owls in the project area to use. Other nearby forested stands in the project area may support red-backed voles, although at lower densities than in the old growth spruce-fir forest categorized as boreal owl habitat. These stands include larch\Douglas-fir and mixed conifer stands to the north and west in sections 1, 11 and 12. Habitat quality of these stands was not assessed, however, and it should not be assumed that they provide other than marginal boreal owl foraging habitat.

Alternatives B and D would alter landscape patch patterns differently. Under alternative D, the eastern part of the boreal owl habitat patch would be harvested, and under alternative B the patch of boreal owl habitat would be divided into two smaller blocks separated by an open area. This patch separation probably would not greatly affect the owls. Suitable boreal owl habitat is often patchily distributed, and the owls are known to travel relatively long distances between roosting and nesting sites. Thus, distribution of habitat patches, and effects associated with habitat fragmentation such as edge effects and patch size, probably are less important than the total amount of available habitat.

4. Fisher

a) Effects of Alternatives A, B, C and D

None of the alternatives would enter the riparian area buffer zones. No harvesting would occur on the 208 acres within 165 feet of perennial streams, or on the 41 acres within 83 feet of intermittent streams. The riparian areas along both perennial and intermittent streams are currently mostly mature timber (89.5 percent on state land and 86.7 percent on Forest Service) and should provide high quality fisher habitat. Habitat value would remain high in the areas most preferred by fisher.

Under Alternative A, the South Fork Lost Creek Road would remain in its current location, and trapper access into preferred fisher habitat would remain high. Under all timber harvest alternatives, this road would be re-routed out of the riparian area. This would improve habitat quality and decrease trapper access into potential fisher habitat . The new road would come to within about 200 feet of the creek at the closest point, and most of the new road would be about 500-600 feet from the creek. The abandoned 1.3 mile portion of the old road would be reclaimed as described at the end of this chapter. This would immediately make the road impassable to motorized vehicles during the snow-free months, and impassable to snowmobiles within a few years as shrubs grow on the roadbed. One unimproved campsite would remain open near the mouth of the South Fork of Lost Creek. Human use of this and other campsites might discourage fisher travel from the Swan valley up into this drainage.

The most important travel routes for fisher from the South Fork of Lost Creek into adjacent drainages are toward the Swan valley floor in the riparian area along the creek, and over the lower elevation ridges in the western part of the project area. Any fisher use of this drainage would be primarily during the summer (Jones 1997), so only summer travel cover was assessed. Fishers avoid non-forest, pole-sapling, and young forest successional stages in the summer (Jones and Garton 1994), although if overhead tree or shrub cover is present they will travel quickly through the area (Jones 1997). DNRC's analysis assumed that forest units treated with structural enhancement would retain travel cover, units treated with light and moderate-reserve treatments would not provide travel cover for 20-40 years until the trees and shrubs would be tall and

dense enough to provide partial canopy cover, and units treated with heavy-reserve treatment would provide adequate cover for travel in 15-20 years when shrubs and trees fill in the understory.

Travel cover would remain in preferred fisher habitat under all alternatives. Under Alternative A, no timber would be harvested and cover for travel would be available over most of the project area. Alternatives B, C, and D would all harvest some acres in the lower elevation western area, which would reduce travel cover into adjacent drainages to varying degrees. Under alternative B, three units (11, 28 and 15 acres) would be harvested with moderate-reserve: these 54 acres would not provide travel cover for about 20-40 years. Under alternative C, one unit (11 acres) would be harvested with moderate-reserve, which would not provide travel cover for 20-40 years. Under alternative D, three units would be treated: unit 1 (40 acres) would be treated with structural enhancement, unit 2 (11 acres) would be treated with moderate-reserve, and unit 3 (260 acres) would be treated with heavy-reserve: thus 11 acres would not provide travel cover for 20-40 years and travel cover over 260 acres would be reduced for about 15-20 years.

5. Lynx

a) Effects of Alternatives A, B, C and D

Potential changes in lynx habitat through timber harvesting include (1) an increase in foraging habitat by the eventual creation of dense stands of young trees, lodgepole pine in particular, which are favored by snowshoe hare, (2) a decrease in denning habitat, (3) changes in trapper access and associated lynx mortality, and (4) reductions in lynx travel cover.

Under Alternative A, no timber would be harvested and snowshoe hare habitat would remain throughout the project area, although of less than optimal quality. Habitat for snowshoe hares might improve in most of the areas harvested with light and moderate-reserve treatments. Habitat improvement for hare probably would be highest in areas that are broadcast burned, have lodgepole pine, and that regenerate with high densities of seedlings. Acreage that would be harvested with light or moderate-reserve treatments and broadcast burned after harvest, are, by alternative: B: 339; C: 215; D: 241. Only one area in the project area currently has predominately lodgepole pine, and this area would be harvested and broadcast burned under alternative B (unit 11, 50 acres) and alternative C (units 15 and 16, 87 acres harvested, of which 41 would be burned). Habitat for snowshoe hare probably would improve in these areas, increasing lynx foraging habitat.

Although snowshoe hare habitat may be improved in the units treated with light and moderate-reserve harvest, cover for lynx travel would be temporarily reduced. Suitable cover for travel consists of coniferous or deciduous vegetation greater than 6 feet high with a closed canopy (USFS 1994). Approximately 10 years would be required after harvest for trees and shrubs in the cutting units to reach this height and provide adequate cover for lynx travel. Cover for travel would not change under Alternative A.

Lynx prefer to den in high elevation spruce-fir forests with high densities of large diameter downed logs. There currently are 247 acres of old growth spruce-fir forest in the southeastern part of the project area, parts of which may provide denning habitat. Alternatives A and C would not harvest any timber in this area and lynx denning habitat would not change in the near term, and may improve in the long term as old trees die and fall. Under alternative B, 46 acres (19 percent) of the 247 acres of old growth spruce-fir forest would be harvested, and under alternative D, 113 acres (46 percent) would be harvested, reducing the amount of lynx denning habitat in the project area.

Trapper access and associated lynx mortality would not change appreciably.

In summary, it is difficult to determine the overall effect of the alternatives on lynx habitat. Lynx are more tolerant of disturbed landscapes than other forest carnivores, and require a mosaic of young and old stands. There is no optimal known ratio of young:old forest for lynx, and approximating the natural disturbance frequency and spatial patterns present on the landscape is expected to provide the best habitat for lynx (USFS 1994). Most of the project area currently is older forest and harvesting some of the older stands might improve habitat for lynx. However, creating foraging habitat at the loss of denning habitat, as in alternative D and to a lesser extent B, might be detrimental.

6. Pileated Woodpecker

a) Effects of Alternatives A, B, C, and D

As described in Chapter 3, the project area contains one 60-acre patch of pileated woodpecker habitat, constituting 2.4 percent of the pileated woodpecker habitat on the SRSF. Alternatives A, B, and C would not harvest any portion of the 60 acres. Alternative D would harvest about 10 percent of the volume in the 60-acre patch with the structural enhancement treatment. This treatment would not diminish habitat quality immediately and might improve it in the long run.

Most of the trees harvested in the patch under Alternative D would be the smaller shade-tolerant true firs and Douglas-fir which are not highly preferred nesting trees. Thinning the stand probably would reduce competition and stress, and promote increased vigor and growth in the remaining trees. Some trees probably would attain larger sizes, which would create larger snags and eventually larger downed logs. Because size is an important attribute of pileated woodpecker nest trees and downed wood used by carpenter ants, these trees could be more valuable habitat in the future than at present. All existing downed wood would remain in place. Timber harvesting would not target large mature trees and should not affect large trees that eventually would become high quality downed wood.

While the harvesting might improve habitat quality in the long run, this could be offset if skid trails created by harvesting make it easier for firewood cutters to enter this area.

Pileated woodpeckers have large home ranges, and any birds that nest in the patch described above would certainly forage in areas outside the patch. We

assumed that areas treated with light or moderate-reserve would provide only marginal foraging habitat after harvest, and areas treated with heavy reserve should provide some foraging habitat although quality would decrease. Alternatives A and C would not harvest near the patch identified as potential pileated woodpecker habitat. Under alternative B, three units would be harvested with the moderate-reserve method (units 1, 2 and 3 totaling 79 acres). Under alternative D, unit 2 (11 acres) would be harvested with the moderate-reserve method, and unit 3 (260 acres) would be harvested with the heavy-reserve treatment.

7. Cumulative Effects

Like the South Fork Lost Creek area, the Cilly Creek drainage has steep topography and large contiguous patches of mature timber and old growth. The Cilly Creek area provides habitat for the same sensitive species as the South Fork Lost Creek area, although Cilly Creek has considerably more pileated woodpecker habitat and less fisher habitat due to the lack of a large perennial stream and associated riparian area.

Because alternatives have not yet been developed for the proposed Cilly Creek timber sale, cumulative effects of the Cilly Creek sale and the South Fork Lost Creek sale cannot be determined. If harvest methods are similar to those used in the South Fork Lost Creek project, the proposed Cilly Creek harvest alternatives can be expected to have some or all of the effects described above on each of the sensitive species, to greater or lesser degrees.

C. Big Game

Big game species included in this analysis include elk and mule deer. A Habitat Effectiveness (H.E.) coefficient, the amount of security habitat in the project area, and the amount and patch size of winter thermal cover on identified winter ranges were used to assess the impacts of different alternatives on elk and mule deer habitat. Derivation of the H.E. and definitions of security and thermal cover are given in Chapter 3.

Regeneration harvest units with light and moderate-reserve treatments are assumed to lose their value as hiding and summer thermal cover as a result of harvesting. Stands treated with heavy-reserve and structural enhancement would retain hiding and summer thermal cover. The analysis area for big game is coterminous with the project area (4,306 acres). Of this 4,306 acres, 4,091 are hiding cover and 3,531 are summer thermal cover. Cattle would remain absent under all alternatives.

1. Habitat Effectiveness

a) Effects of Alternative A

Under Alternative A, hiding cover would remain at approximately 95 percent (4,091 acres) of the project area, and summer thermal cover would continue to cover about 82 percent (3,531 acres) Cattle would remain absent and open road density would remain 0.61 miles per square mile, continuing the current 71 percent H.E. in the project area.

B) Effects of Alternative B

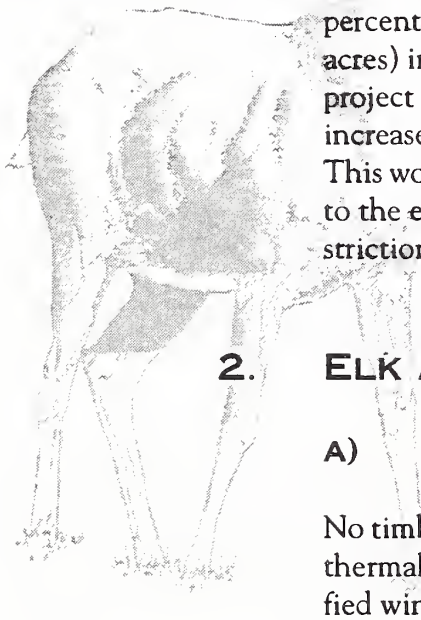
Hiding and summer thermal cover would be reduced by 492 acres leaving 83 percent (3,574 acres) of the project in hiding cover and 70 percent (3,374 acres) in summer thermal cover. Use of currently restricted roads and building of new roads would increase the open road density in the project area to 1.5 miles per square mile. This would result in an H.E. of 54 percent. H.E. would return to 71 percent upon completion of the project and restriction of roads built or opened for this project.

C) Effects of Alternative C

Hiding and summer thermal cover would be reduced by 454 acres leaving 84 percent (3,617 acres) of the project area in hiding cover and 71 percent (3,057 acres) in summer thermal cover. Open road density would increase in the project area to 1.8 miles per square mile reducing H.E. to 51 percent. H.E. would return to 71 percent upon completion of the project and restriction of roads built or opened for this project.

D) Effects of Alternative D

Hiding and summer thermal cover would be reduced 277 acres, leaving 83 percent (3,574 acres) of the project area in hiding cover and 70 percent (3,014 acres) in summer thermal cover. Cattle would continue to be absent from the project area. Use of currently restricted roads and building of new roads would increase the open road density in the project area to 1.6 miles per square mile. This would result in an H.E. of 53 percent. Habitat effectiveness would return to the existing condition, 71 percent, upon completion of the project and restriction of roads built or opened for this project.



2. Elk and Mule Deer Winter Range

A) Effects of Alternatives A and C

No timber harvesting would occur on elk and mule deer winter ranges. Winter thermal cover would remain at 54 acres, 23 percent of the 235 acres of identified winter range in the project area.

B) Effects of Alternatives B and D

Either of these alternatives would harvest an 11.3 acre patch of winter thermal cover. Approximately 43 acres (19 percent of the total 235 acres) of winter range would remain in thermal cover. The largest of the four thermal cover patches (23 acres) would remain intact.

3. Elk Security

a) Effects of Alternative A

Under Alternative A, 45.5 percent of the project area (1,917 acres of the total 4,306) would remain elk security habitat (defined in Chapter 3).

b) Effects of Alternatives B, C, and D

Use of currently restricted roads would reduce elk security habitat to approximately 450 acres (10 percent of the project area). Elk security would return to the present 45.5 percent when open roads are again restricted.

4. Cumulative Effects

The Middle Soup timber sale will not contribute to a cumulative effect on big game species since it does not overlap the South Fork Lost Creek project area. Open road density decreased when roads were closed in conjunction with of the Middle Soup sale. The proposed Cilly Creek timber sale project area is adjacent to the proposed South Fork Lost Creek timber sale, though a large ridge separates the two. If the road system in the eastern portion of the South Fork Lost Creek timber sale is kept open to provide access to the Cilly Creek sale, habitat effectiveness and elk security values will remain as described for Alternatives B, C, and D. Road building for the proposed Cilly Creek project would cause a loss of elk security in the Cilly Creek drainage, which currently serves as a displacement area for big game from the South Fork Lost Creek timber sale area.

V. WATERSHED

A. Water Quality

The primary effect of forest management practices on water quality is sediment delivery to streams. Sediment is generated by road construction and use, especially from roads constructed along or across streams. Timber harvest in or near riparian areas also can reduce the filtering capacity normally provided by vegetation in these areas. None of the alternatives would harvest timber in riparian areas. The harvest activities proposed in all timber harvest alternatives would fully comply with BMP and the Montana SMZ law to minimize the risk of increased sedimentation from harvest units. No harvesting would occur in an SMZ under any alternative. DNRC has agreed to implement the immediate actions for bull trout restoration recommended by the Governor's Bull Trout Restoration Team.

1. Effects Common to all Timber Harvest Alternatives

No alternative would harvest timber in a Streamside Management Zone. A 1.3 mile portion of the South Fork Lost Creek road would be permanently closed and the roadbed rehabilitated. This portion of road would be replaced with 1.7 miles of new road up the slope and away from the creek. The bridge over Cliff Creek and the two bridges over the South Fork Lost Creek are potential sources of sediment and would be replaced under any harvest alternative. Surface drainage features would be installed on approximately 10.3 miles of road in the South Fork Lost Creek watershed to bring

them up to current BMP standards. Short-term increases in sediment and turbidity might result from these proposed activities, but they would lead to a net long- term benefit to water quality by stabilizing existing sources of sediment and improving surface drainage and potential for sediment delivery.

2. Effects of Alternative A

Under the no-action alternative, no new roads would be constructed and no timber would be harvested in the South Fork Lost Creek watershed. None of the proposed stream crossing replacements, road improvements, road relocation, or repair of existing sediment sources would be completed. These problems would continue to recover or degrade as dictated by natural and preexisting conditions.

3. Effects of Alternative B

This alternative would harvest approximately 626 acres, roughly 350 with either a helicopter or cable system. Approximately 125 acres of proposed harvest would use low ground pressure tractors which disturb the ground much less than conventional ground-based equipment. Approximately 1.3 miles of road would be built to provide access to timber.

4. Effects of Alternative C

This alternative would harvest approximately 668 acres in the South Fork Lost Creek watershed, about 520 of them with either a helicopter or cable yarding system. Only 79 acres would be harvested with conventional ground-based equipment. The remainder of the harvest would be performed with low ground pressure equipment as described under Alternative B above. Approximately 1.9 miles of new road would be constructed to reach the proposed harvest units.

5. Effects of Alternative D

This alternative would harvest timber from approximately 695 acres in the South Fork Lost Creek watershed. Roughly 150 acres would be harvested with helicopter or cable yarding systems. The remaining area would be harvested with ground-based machinery, including about 120 acres with low ground pressure tractors. This alternative would require approximately 1.7 miles of new road to reach harvest units.

B. Cumulative Watershed Effects

The potential watershed cumulative effects of the alternatives were determined using the PC version of the R1WATSED model developed by Region 1 of the USFS. All modeling results are estimates based on empirical formulas, and should be used for comparison of alternatives rather than as actual values. WATSED uses the Equivalent Clearcut Area (ECA) method in estimating the increase in water yield caused by removal of live trees. This model also estimates sediment production and delivery resulting from road construction and timber harvest. WATSED is limited in its estimates of sediment routing because it does not account for sediment generated from the bed and banks of a stream adjusting to increases in water yields, or to mitigation measures that limit sediment production.

All the timber-harvest alternatives would mitigation activities not included in the WATSED model, resulting in lower sediment production than the model predicts. These activities would include installation of surface drainage on roads, removal of two deteriorating bridges, and replacement of 1.3 miles of the South Fork Lost Creek road where it runs along the creek.

1. Effects of Alternative A

The no-action alternative would generate no cumulative watershed impacts beyond those under current management. ECA levels, water yield increases, and sediment increases would remain at or near present levels and would continue to decline as past harvest units continue to regenerate and move closer to pre-disturbance levels of water use and snowpack distribution.

2. Effects of Alternative B

Three miles of new road (1.3 miles to harvest units and 1.7 to replace the South Fork Lost Creek road) and 626 acres of timber harvest under this alternative would generate approximately 464 ECA, and bring the water yield increase from its current level of 1 percent over natural to 3 percent over natural (see table 4-5).

WATSED indicates Alternative B would generate some potential increase in sediment yield. The potential for these increases would return to pre-harvest levels in about 4 years. The potential increased sediment yield predicted by WATSED would result primarily from the use of conventional ground-based harvest actvities and road constuction.

3. Effects of Alternative C

Approximately 3.6 miles of new road construction (1.9 miles to reach harvest units, 1.7 miles to replace the closed segment of the South Fork Lost Creek road) and 668 acres of harvest under this alternative would generate approximately 437 ECA and bring the water yield increase from its current level of 1 percent over natural to 3 percent over natural (see table 4-5).

WATSED indicates Alternative C would generate some potential increase in sediment yield. These potential increases would return to pre-harvest levels in about 4 years. The potential increased sediment yield predicted by WATSED would result primarily from the use of conventional ground-based harvest actvities and road constuction.

4. Effects of Alternative D

This alternative would include harvest of 695 acres of timber and construction of approximately 3.4 miles of new road (1.7 miles to harvest units; 1.7 to replace South Fork Lost Creek road). These activities would generate approximately 317 ECA, and bring the water yield increase from its current level of 1 percent over natural to 2 percent over natural (see table 4-5).

The ECA generated in this alternative are low relative to the acres harvested, and are lower than those from the other timber harvest alternatives. This is because approximately 40 acres under this alternative would receive the structural enhancement harvest treatment, which would retain approximately 90 percent of the basal area. Acres treated with structural enhancement do not generate ECA according to WATSED and

various research indicates that changes in soil moisture and snowpack distributions are not detectable when 10 percent or less basal area is removed (Troendle, 1989, and Troendle and King, in press). It is generally accepted that 15 to 30 percent of crown cover must be removed before measurable changes in water yield occur.

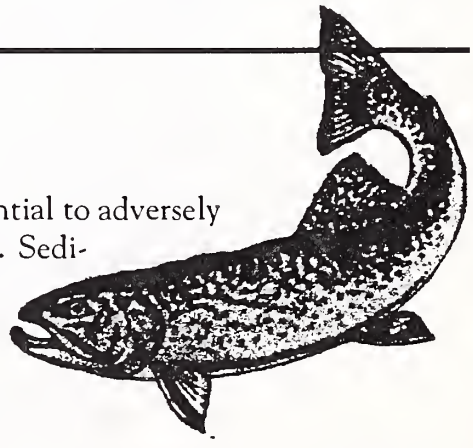
WATSED indicates Alternative D would generate some potential increase in sediment yield. These potential increases would return to pre-harvest levels in about 10 years. The increased potential sediment yield predicted by WATSEDwould result primarily from the use of conventional ground-based harvest actvities and road constuction.

TABLE 4-5. COMPARISON OF WATSED PREDICTED WATERSHED EFFECTS BY ALTERNATIVE FOR SOUTH FORK LOST CREEK

Watershed Effects	ALTERNATIVES			
	A	B	C	D
Acres Harvested	---	626	668	695
Miles of New Road 1	---	3.0	3.6	3.4
ECA Generated	---	464	437	317
Total ECA[2]	319	783	756	636
Allowable ECA	3,939	3,939	3,939	3,939
% Increase Over Natural Runoff 3	1%	3%	3%	2%
Allowable Increase Over Baseline Runoff	10%	10%	10%	10%

1 "New Road" would include 1.7 miles to replace the South Fork Lost Creek road under every harvest alternative.
[2] All values are based on projection year 1998
[3] Natural condition was determined by WATSED using empirical formulas, and are not based on measured values on the ground. Use values only as a comparison among alternatives.

VI. FISHERIES



Sedimentation generated by proposed timber harvest has the potential to adversely affect the quality of bull trout and west slope cutthroat trout habitat. Sedimentation is a fisheries related issue which is discussed in the watershed portion of this document.

A. EFFECTS OF ALTERNATIVE A

The fisheries habitat condition would remain essentially unchanged. Erosion sources would not be remedied under the sale proposal. Monitoring of fisheries habitat by DNRC would be discontinued for the South Fork Lost Creek until future projects present the need for additional data.

B. EFFECTS OF ALTERNATIVES B, C AND D

As agreed to in the immediate actions for bull trout recovery, none of the timber harvest alternatives would harvest in an SMZ containing a bull trout stream. All proposed cutting unit boundaries are well away from SMZ boundaries. All timber harvest alternatives would permanently close 1.3 miles of the existing South Fork Lost Creek road and replace it with a 1.7-mile

segment farther up slope, replace the Cliff Creek bridge, remove and rehabilitate the two bridges over the South Fork Lost Creek which were identified as potential sources of sediment, and install surface drainage features on approximately 10.3 miles of existing road so all roads meet current BMP standards at a minimum. These activities would lead to short term increases in sedimentation during construction. As the sites revegetate and stabilize, there probably would be a long-term benefit to fish habitat by the elimination of long-term and chronic sources of sediment.

All proposed harvest activities present a low risk of impact to fisheries habitat or populations due to implementation of BMP, the SMZ law, Immediate Actions for Bull Trout Restoration, and the Flathead Basin Forest Practices Water Quality and Fisheries Cooperative recommendations.

Fisheries monitoring would continue annually through the duration of the project and for at least 1 year after project completion under any of the timber harvest alternatives.

VII. AIR QUALITY

After timber harvesting, cutting units are burned to reduce logging residue such as nonmerchantable treetops and limbs. Burning logging residue decreases the risk of wildfire by reducing fuel loading. It also prepares sites for tree regeneration. Burning is usually conducted during the late summer or early fall when weather conditions and fuel moisture levels are optimal to meet burning objectives. During burning periods, smoke would temporarily reduce air quality in the vicinity of the project area.

Light- and moderate-reserve treatments would generate the most residues and the greatest potential affect to air quality.

Structural enhancement treatments would not affect air quality because no burning would be required. For this treatment, logging residue would be hand-lopped and scattered.

A. Effects of Alternative A

Alternative A would not affect air quality. No timber harvesting and no burning would occur.

B. Effects of Alternatives B, C and D

Air quality effects would not exceed the limits defined by the Montana Cooperative Smoke Management Plan (State of Montana Cooperative Smoke Management Plan 1988).

C. Cumulative Effects

Air quality cumulative effects would not exceed the limits defined by the Montana Cooperative Smoke Management Plan (State of Montana Cooperative Smoke Management Plan 1988).

VIII. VISUAL QUALITY

DNRC used computer generated images to perform a visual analysis of the project area from various view points. It was determined that the project area could be viewed from the south end of Swan Lake, forest roads within the project area, and the western flank of the Swan valley across from the project area. Each of the timber harvest alternatives would have an effect on the vistas from each of these locations.

A. Effects of Alternative A

Alternative A would not affect the visual characteristics of the project area. However, the visual character of the project area would gradually be altered by natural processes and natural disturbances over time.

B. Effects of Alternative B

Light-reserve and moderate-reserve harvest would affect the visual quality of the area. Fifteen of these harvest units would be scattered throughout the project area ranging in sizes from approximately 10 to 55 acres. All of these units would be visible from forest roads (10 from open roads and five from closed roads) within the sale area. Units adjacent to roads would be screened from view by a visual buffer consisting of a fringe of trees. Two units averaging about 40 acres in size would be visible from Swan Lake and the western flank of the valley.

One heavy-reserve harvest unit, visible from all three viewing areas, also might affect the visual quality of the area. The heavy-reserve treatment leaves roughly 50 percent of the timber standing after harvest, so visual impacts should be minimal. This harvest unit would be most noticeable from forest roads within the project area.

C. Effects of Alternative C

Light-reserve and moderate-reserve harvest units would affect the visual quality of the area. Sixteen of these harvest units ranging in sizes from approximately 9 to 81 acres would be scattered throughout the project area. All of these units would be visible from forest roads (11 from open roads and 5 from closed roads) within the sale area. Units adjacent to roads would be screened from view with a visual buffer of vegetation. Six units averaging about 14 acres probably would be visible from Swan Lake and the western flank of the valley. These six units, when viewed from a distance, would give the appearance of two openings, one of about 11 acres and the other roughly 75 acres.

Two heavy-reserve harvest units also might affect visual quality of the area. These units would be visible only from forest roads (both open and closed) in the project area. Approximately 50 percent of the timber would be left standing within these stands so visual impacts would mitigated to a degree.

D. Effects of Alternative D

Under Alternative D, seven light-reserve and moderate-reserve harvest units ranging in size from 11 to 116 acres would be scattered throughout the project area. All of these units would be visible from forest roads (both open and closed) within the sale area. Units adjacent to roads would be screened from view by a buffer of vegetation. One unit about 40 acres in size would be visible from Swan Lake and the western flank of the valley.

Two heavy-reserve harvest units also might affect visual quality of the area. These units would be visible from all three viewing areas, but probably only noticeable from the forest roads. Approximately 50 percent of the timber would be left standing after harvest and visual impacts probably would be minimal.

The structural enhancement silvicultural treatment would be used to harvest one stand of approximately 40 acres. This unit would only be visible from a closed forest road. Harvest in this stand would leave roughly 90 percent of the volume standing after harvest, and visual impacts would be minimal.

IX. RECREATION

The South Fork Lost Creek drainage is used for a variety of recreation, including hiking, biking, fishing, camping, hunting, cross country skiing, and wildlife viewing. No detailed recreational use studies have been conducted in or near the project area. This makes it difficult to determine the number and type of users that recreate in this area and the effect the proposed sale would have on recreation. Due to a general trend of population increase in the Flathead valley and Swan valley and the increasing interest in Northwest Montana by potential visitors, recreational use of the area would probably increase. The improvements that would be made to the South Fork Lost Creek Road, which provides access to Forest Trail 98 into the Bob Marshall Wilderness, also could lead to an increase in recreational use. Timber harvest would not eliminate any of the recreation opportunities that currently exist. Some opportunities would be improved, some would decline, and others would remain unchanged.

X. ECONOMICS

The economic analysis for the South Fork Lost Creek Project estimates the revenue from timber harvesting and non-administrative costs for the alternatives considered and displays the current returns from the Northwest Land Office timber program and the total program state wide.

The results of this analysis appears in Table 4-6. Also, see Appendix D for specific information on the assumptions and methodology used for the economic analysis.

A. Costs and Revenues from the DNRC Forest Sale Program

DNRC does not have an accounting system to track costs for individual projects from start to finish. An annual cash flow analysis was conducted of DNRC's forest product sales program. Revenue and costs are calculated by land office and state wide. The revenue-to-cost ratios for the Northwest Land Office for fiscal year 1994 was 3.33, with 2.41 for 1995, and 1.51 for 1996.

Total revenue is revenue from timber sales, permits, Forest Improvement and road maintenance, and total cost is the sum of timber operating and general administration costs. Net Return is total revenue less total cost. For specific information on assumptions related to revenue or cost are contained in the User's Guide for Timber Accounting Summary (TAS), Montana Department of State Lands.

TABLE 4-6. COSTS AND BENEFITS ASSOCIATED WITH THIS PROJECT BY ALTERNATIVE.

	ALTERNATIVES			
	A	B	C	D
Estimated Total Harvest Volume (M.F.)	0.00	9,666	10,042	9,982
Development Cost ($/M.F.)	0.00	$23.37	$22.50	$22.63
Stumpage Value ($/M.F.)	0.00	$91.52	$49.74	$109.41
Forest Improvement ($/M.F.)	0.00	$46.41	$46.41	$46.41
Stumpage Value, Forest Improvement and Development Cost ($/M.F.)	0.00	$161.30	$118.65	$178.45
Total $ Value based on Stumpage, FI cost and Development Cost times estimated harvest volume	0.00	$1,559,126	$1,191,483	$1,781,288
Stumpage and Forest Improvement (FI) ($/M.F.)	0.00	$137.93	$96.15	$155.82
Total $ Revenue to the State (Stumpage + FI cost times estimated harvest volume)	0.00	$1,333,231	$965,538	$1,555,395
Total $ Return to the Trust Fund	0.00	$884,632	$499,489	$1,092,131
Sale Specific Forest Improvement Costs ($/M.F.)	0.00	$15.92	$11.18	$14.35
Total $ Sale Specific Forest Improvement Costs	0.00	$153,838	$112,262	$143,253

TABLE 4-7. THE NET RETURN/TOTAL REVENUE AND REVENUE/COST RATIOS (TIMBER SALE ACCOUNTING SUMMARY -- FY95 & REVISED FY94 MEMO, FY96.)

	Net Return/Total Revenue Ratio			Total Revenue/Total Cost Ratio		
	FY94	FY95	FY96	FY94	FY95	FY96
Northwest Land Office	0.70	0.59	0.34	3.33	2.41	1.51
Total Program	0.63	0.52	0.40	2.68	2.07	1.68

B. Effects of Alternatives A, B, C and D

The impacts on local communities are estimated by quantifying jobs and income associated with harvesting and processing the timber into final products. Regional response coefficients estimated for northwestern Montana indicate that timber harvesting provides 10.58 direct jobs per MMBF, and a total direct income of $ 337,146 (Keegan *et al.*) for an average annual income of $ 31,866.35 per job.

It is important to note that the response coefficients are an accounting of what has happened historically. These response coefficients are average values and are not marginal values. To say the consequence of not selling this sale would result in the loss of XX amount of jobs and YYY amount of income may not be correct. A marginal analysis would have to be done in order to be more certain that there would be a reduction in income and employment. Lack of a marginal analysis and the use of average numbers commonly results in over estimation of the total economic effects (Godfrey and Beutler 1993).

XI. MITIGATION COMMON TO ALL ALTERNATIVES

The following mitigation measures are common to all timber harvesting alternatives. They supplement the mitigation specific to each alternative which are described in Chapter 2. Both specific and common mitigations are based on environmental laws, DNRC policies, DNRC standards and guidelines, consensus of scientific literature, and professional judgement. Implementing of these mitigations is intended to ensure that each alternative complies with pertinent environmental laws, policies, and standards and guidelines.

A. Soil and Noxious Weeds

- Comply with BMP for proper drainage on roads.
- Maintain roads and drainage features.
- Schedule management activities to avoid excessive rutting and compaction Clean road construction and skidding equipment of weed seeds, plant parts, and mud before bringing this equipment on site.
- Apply grass seed to exposed soil as soon as possible after disturbance.
- Where possible use existing skid trails and landings to minimize cumulative impacts.
- Where slopes are steeper then 45 percent or where sensitive soils are found, restrict use of conventional ground-based equipment to avoid soil displacement and erosion.
- Weeds would be sprayed with herbicides using spot applications when necessary (Categorical Exclusion 1997, in project file).

B. Roads

Road reconstruction and maintenance work would be performed along Forest Service roads #680 and #9521. Approximately 1.7 miles of road would be built to replace a portion of Road #680 that is close to the creek and in danger of being eroded.

Potential sediment source sites (see Chapter 3 and 4, Watershed) would be mitigated and corrective actions, such as installation of drainage features and removal of two bridges, would take place as part of this project. Control of noxious weeds also would be treated as part of all road projects.

C. Wildlife

1. Grizzly bear

- All timber harvest alternatives meet the intent of the Swan Valley Grizzly Bear Conservation Agreement (see Grizzly Bear affects assessment in this chapter for more information).
- No more than 33 percent of any grizzly bear subunit shall exceed 1 mile per square mile of open road density, to lessen vulnerability to human-caused mortality and displacement.
- Timing and duration of harvest activities would be scheduled to limit displacement from core areas, linkage zones, and other areas of suitable habitat.
- Huckleberry bushes and their root systems would be preserved during scarification.
- A visual screening buffer would be left along open roads and along restricted roads that are located along the outside edge of even-aged harvest units. Exceptions might be required where cable logging systems are used.
- Cover "vegetation blocks" would be retained within large even-aged harvest units to ensure that no point in the unit is more than 600 feet from cover.
- Hiding cover would be retained on 40 percent of the grizzly subunit.

2. Sensitive Species

- Timber harvesting activities would be restricted until after July 15 to protect nesting birds. Road reconstruction and construction, slash disposal and scarification would be permitted before July 15.
- Retain and enhance wildlife travel corridors when designing harvest units.

D. Watershed and Fisheries

- Meet Best Management Practices and Streamside Management Zone rules.
- Improve surface drainage system, if necessary, on existing roads.
- Schedule timing and duration of harvest activities to reduce potential soil displacement and sediment delivery to streams.

E. Air Quality

- Follow smoke management guidelines that are regulated by the Montana Cooperative Airshed Program.

XII. Irretrievable and Irreversible Commitments of Natural Resources

A. Irretrievable

Many stands in the project area are mature with many individual trees more than 200 years old. Any of the timber harvest alternatives would cause some of these large, old, live trees to be irretrievably lost; they would no longer contribute to future snag recruitment, stand structural and compositional diversity, aesthetics, wildlife habitat, nutrient recycling processes or any other important ecosystem functions.

B. Irreversible

The initial loss of trees due to timber harvesting would not be irreversible. Natural regeneration combined with site preparation and artificial regeneration would promote the establishment of new trees. If management decisions allow for the continued growth of established trees, they would ultimately become equivalent in size and age to the irretrievable, harvested trees.

APPENDIX A

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NEWS RELEASES SENT FOR PUBLICATION (11/30/94)

Bigfork Eagle, P.O. Box 406, Bigfork 59911 837-5131 (December 7th)

Daily Interlake, Box 7610, Kalispell 59904 755-7000 (December 9th-11th)

Pathfinder, Box 702, Seeley Lake 59868 677-2022 (December 8th)

APPENDIX B

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APPENDIX C

SENSITIVE SPECIES

The SFLMP directs DNRC to give special consideration to the following species when conducting forest management activities: boreal owls, fisher, lynx, pileated woodpecker, western big-eared bat, northern bog lemming, flammulated owl, black-backed woodpecker, common loon, harlequin duck, and Coeur d'Alene salamander. These species are sensitive to human activities or require special habitat that may be altered by timber management, or may become listed under the federal Endangered Species Act unless management can improve their long-term prospects. Because sensitive species usually have specific habitat requirements, consideration of their needs serves as a useful "fine filter" for ensuring that the primary goal of maintaining healthy and diverse forests is met.

Five of these species (flammulated owl, common loon, harlequin duck, Coeur d'Alene salamander, northern bog lemming) would not be affected by the proposed project (see discussion below). The remaining six species are discussed in Chapters 3 and 4 of this document.

I. Flammulated Owl

The flammulated owl breeds in north America in the spring and summer, and migrates to the tropics for the winter (McCallum 1994). Flammulated owls typically nest in mature to old growth ponderosa pine or ponderosa pine\Douglas-fir montane forests. In the Rocky Mountains, flammulated owls typically nest in stands with moderate canopy closure (30-50 percent), at least two canopy layers, and an open understory composed of regenerating trees, pinegrass and shrubs. All published North American records of nesting, except one, came from forests in which western yellow pine was present, if not dominant (Reynolds and Linkhart 1992).

There are only 36 acres in the project area where timber stands comprise more than 25 percent ponderosa pine, and none of these stands is more than 60 years old, making them unsuitable for flammulated owl nesting. Given the lack of preferred flammulated owl breeding habitat in the project area, this species was dropped from further analysis.

II. Common Loon

Loons nest immediately adjacent to water, usually lakes at least 10 acres in size. The fast running creeks and streams in the project area do not provide suitable loon habitat. The closest loon nests are approximately 7 miles north and 16 miles south of the project area (Montana Natural Heritage Program 1997). Management for loon habitat is not required in areas that do not have documented loon nesting (Skarr 1989), so no further analysis of this species will be done in this document.

III. Harlequin Duck

Harlequin ducks use swift, clean, clear streams with stream bottom rock ranging in size from cobble to boulder. Extensive surveys for harlequin ducks in the Swan Valley have found none. The project area is far from any known populations, and the probability of recolonization of this area by harlequin ducks is very small (Reichel 1997). For these reasons, the project will not affect harlequin ducks and they will be dropped from further analysis.

IV. Coeur d'Alene Salamander

This amphibian has been found in springs, seeps, waterfall spray zones, or wet, mossy talus along small, steep, cascading streams with fractured rock formations and dense overhead canopies. To date, presence of Coeur d'Alene salamanders has been documented only in Lincoln and Mineral counties in Montana, and the SRSF is considered outside of its range. Although at least one and possibly three areas in the project area may meet the habitat requirements for Coeur d'Alene salamanders, no harvest would occur within at least 50 meters of these and habitat quality would not be altered. For these reasons Coeur d'Alene salamanders would not be affected and are dropped from further analysis.

V. Northern Bog Lemming

Preferred bog lemming habitat is bogs or fens with large, thick moss mats, particularly sphagnum. These areas generally are open in character with some shrubs, and some have up to 40 percent canopy coverage of subalpine fir or spruce. Few known bog lemming populations exist and surveys in the swan valley have not found northern bog lemmings. Most of the project area is steep, rocky well-drained ground which could not support sphagnum bogs. For these reasons the project will not affect bog lemmings and they will be dropped from further analysis.

APPENDIX D

ECONOMIC ASSUMPTIONS/ METHODOLOGY

The economic analysis for the South Lost Project estimates the revenue from timber harvesting and non-administrative costs for the alternatives considered and displays the current returns from the Northwest Land Office timber program and the total program state wide. The results of this analysis appears in Chapter 4, Table 4-4.

A. COST ASSUMPTIONS

The following assumption were used to estimate the revenue and non-administrative costs for each alternative:

1. The harvested volumes for the alternatives were based on the current standing volume (net) from Stand Level Inventory and the following rules:

Structural Enhancement	=	10% Standing Volume
Heavy Reserve	=	50% Standing Volume
Moderate Reserve	=	80% Standing Volume
Light Reserve	=	90% Standing Volume

2. The stumpage price was estimated using a residual value approach. The estimated value of deliver log prices were subtracted from stump to mill costs, Forest Improvement fee, development costs and an amount for profit and risk.

3. The estimated deliver log price was based on the most current Montana Sawlog and Veneer Log Price Report (Based on a survey of mills October - December, 1996) from Bureau of Business and Economic Research, The University of Montana. We used the Average Sawlogs prices from Region 2 Western Montana. The species break down by alternative was based on the current Stand Level Inventory species percentages and along with the silvilcultural treatment option. (See appendix for species percentage current, harvested and residual.)

4. Logging costs were estimated from, Costs Associated with Harvest Activities for Major Harvest Systems in Montana (Keegan, Charles, at el 1995). The costs were adjusted to current dollars. The logging costs used were; tractor = $101.28 per MBF, FMC = $138.41 per MBF (used forwarder system cost to estimate FMC cost), Cable = $ 168.80 per MBF, and Helicopter = 262.19 per MBF. The average logging cost by alternative was calculated based on a volume weighted average. Acres by harvesting method was calculated using the GIS.

5. Development costs were estimated for each alternative by Swan Unit personal. They were similar enough across alternatives that a constant value was used for all alternatives. The total development cost = $225,926. With an estimated total road development cost = $218,426 and the estimated cost of the FRTA contract = $ 7,500. Development costs on this proposal are the esti-

mated costs of road, easement acquisition and watershed improvement items that would be paid for by the purchaser. These improvements provide access to the State Trust Lands involved and improve water quality on State Land.

6. Forest Improvement (FI) cost is base on the cost to maintain the ongoing staffing, stand and road maintenance treatments needs for the current year, right-away acquisition and program wide costs. Funds collected under FI from a purchaser provide the State funding to accomplish projects such as tree planting; site preparation; slash treatment; thinning; road maintenance; road acquisition; and for some timber sale related activities. Thus, the State is able to improve the long-term productivity of timber stands on State land and maintain or acquire access for future revenue-producing projects.

7. Sale Specific Forest Improvement costs (SSFI) are the current cost estimates for the amount and types of treatments (site preparation, hazard reduction, planting, etc) that would be done related to each of the alternatives being considered. Funding to complete these projects will be collected from current or future timber sales depending on the timing of the treatments.

8. The estimated Total $ return to the Trust is the stumpage value (bid price $/MBF) times the estimated harvest volume.

9. The estimated total dollar amount collected by the State (Total Revenue) is Forest Improvement costs plus the stumpage value times the estimated harvest volume.

10. Another estimated cost associated with this project that will be applied to all action alternatives is for fisheries monitoring $20,000.

11. Sale Specific Forest Improvement Costs were estimated based on the following costs: Machine Pile and Scarification = $135.75 per acre (including burning piles), Broadcast burn = $230 per acre (recent contract burring on Plains Unit), Lop and scatter = 12.50 per acre (used in Units with site preparation of None), Full Planting cost = $122 per acre (Seedling cost .2 cent per tree, planting cost of .18 cent per tree for planting 300 tree per acre and $7.25 per acre administration cost), and partial planting cost $47 per acre (Seedling cost .2 per tree, planting cost of .2 per tree for planting 100 tree per acre and $7.25 per acre administration cost). These costs were estimated based on a discussion with Dan Cassidy. The treatment acre by alternative are as follows:

TABLE D-1. TREATMENT ACRES BY ALTERNATIVE

Alternative	Treatment Method				
	Broadcast Burn	Machine Pile & Burn	Lop & Scatter	Full Planting	Partial Planting
B	339.6	286.6	0.0	44.7	326.3
C	220.1	118.8	329.1	45.7	246.1
D	283.7	370.6	40.3	186.3	118.3

12. The costs related to the administration of the timber sale program is only tracked at the Land Office and State-wide level. We don't keep track of costs for individual timber sales.

13. Limitations of the economic analysis: (1) Only known costs and benefits that are related to timber harvesting activities are considered; (2) None of the potential benefits associated with leaving trees (i.e. snag recruitment, structural diversity, aesthetics, wildlife habitat, nutrient recycling, etc.) are considered.

TABLE D-2. RV APPRAISAL ASSUMPTIONS FOR SOUTH LOST PROJECT BY ALTERATIVE.

RV Appraisal Assumptions (per MBF)	Alt B	Alt C	Alt D.
Delivered Log Prices	$408.81	$404.68	$413.27
Logging Cost	($172.11)	($206.04)	($161.58)
Haul Cost	($40.86)	($40.86)	($40.86)
Road Development	($23.80)	($22.59)	($22.64)
Forest Improvement Fee	($46.41)	($46.41)	($46.41)
Other Costs	($2.11)	($2.00)	($2.00)
Profit and Risk	($32.00)	($37.04)	($30.37)
Estimated Stumpage	$91.52	$49.74	$109.41

TABLE D-3. ESTIMATED SPECIES PROPORTIONS BASED ON STAND LEVEL INVENTORY FOR CURRENT CONDITIONS, HARVESTED AND RESIDUAL FOR ALTERNATIVE B.

Species Code	Proportions		
	Currently	Harvested	Residual
L	26.12	25.69	27.32
D	16.83	11.08	32.90
L	8.54	5.41	17.30
S	26.64	30.18	16.73
AF	15.35	19.81	2.88
GF	0.44	4.26	0.00
WB	0.44	2.98	0.00
WP	2.98	2.98	2.87
TOTAL	100.00	100.00	100.00

14. Alternative A - No Action. We do not have any current money making activities that are solely dependent on this project area.

TABLE D-4. ESTIMATED SPECIES PROPORTIONS BASED ON STAND LEVEL INVENTORY BY UNIT FOR ALTERNATIVE B. (THE CHARACTER(S) IS THE SPECIES CODE AND THE NUMBER IS THE ESTIMATED SPECIES COMPOSITION IN THE STAND.)

Unit	Acres	Current				After Harvest			
		Spec 1	Spec 2	Spec 3	Spec 4	Spec 1	Spec 2	Spec 3	Spec 4
1	11.3	D3	L3	GF3	P0	D5	L5		
2	30.9	C4	GF3	WP1	D1	D6	C4		
3	36.5	C4	GF2	WP2	D2	D6	C2	WP2	
4	54.7	C5	S3	D2	WP1	D6	C2	WP2	
5	117.4	C4	S2	L2	D1	C5	S2	L2	D1
8	54.0	D3	S2	C2	AF2	D6	S2	C2	
7	42.3	S5	AF4	L1	C0	L6	AF3	S1	
8	26.1	S5	AF3	D1		D5	S5		
9a	8.2	S4	AF3	D2	WB0	D6	S4		
9a	41.4	S4	AF3	D1	WB1	D6	S4		
10	18.9	S7	AF3			S7	AF3		
11	50.3	D3	AF2	L2	C2	D6	C4		
12	19.8	C4	L2	D2	WP1	L6	D4		
13a	12.0	C3	L2	D2	AF1	L5	D4	C1	
13b	0.7	C4	L2	D2	WP1	L5	D4	C1	
14b	30.2	C3	D3	L2	AF1	D5	L4	C1	
14b	7.1	C4	L2	GF2	D2	L5	D4	C1	
15	9.3	S6	AF3	D1		D6	S1		
16	44.7	S6	AF4			S6	AF4		

Species codes are: AF - Subalpine fir, C - Western red cedar, D - Douglas-fir, GF - Grand fir, L - Western Larch, P - Ponderosa pine, S - Engelmann spruce, WP - Western white pine, and WB - Whitebark pine.

The following codes were used for percent of total stocking: 0 = 0-9%; 1 = 10-19%; 2 = 20-29%; 3 = 30-39%; 4 = 40-49%; 5 = 50-59%; 6 = 60-69%; 7 = 70-79%; 8 = 80-89%; 9 = 90-100%.

TABLE D-5. ESTIMATED SPECIES PROPORTIONS BASED ON STAND LEVEL INVENTORY FOR CURRENT CONDITIONS, HARVESTED AND RESIDUAL FOR ALTERNATIVE C.

Species Code	Proportions		
	Currently	Harvested	Residual
L	34.09	36.61	29.05
S	23.42	19.74	30.80
L	11.29	8.15	17.60
S	15.73	16.45	14.29
AF	13.44	16.11	8.09
GF	1.54	2.22	0.17
WB	0.48	0.72	0.00
TOTAL	100.00	100.00	100.00

Species codes:
AF - Subalpine fir
C - Western red cedar
D - Douglas-fir
GF - Grand fir
L - Western Larch
P - Ponderosa pine
S - Engelmann spruce
WP - Western white pine
WB - Whitebark pine

TABLE D-6. ESTIMATED SPECIES PROPORTIONS BASED ON STAND LEVEL INVENTORY BY UNIT FOR ALTERNATIVE C. (THE CHARACTER(S) IS THE SPECIES CODE AND THE NUMBER IS THE ESTIMATED SPECIES COMPOSITION IN THE STAND.)

Unit	Acres	Current				After Harvest			
		Spec 1	Spec 2	Spec 3	Spec 4	Spec 1	Spec 2	Spec 3	Spec 4
1	11.3	C9	S0			C9	S0		
2	28.2	C7	S2	L1	WP0	L5	C3	S2	
3	14.9	C8	S2	L1	WP0	L5	C3	S2	
4	10.0	C7	S2	L1	WP0	L7	C3	S2	
5	11.3	C7	S2	L1	WP0	L7	C3	S2	
6	11.1	D7	L2	GF1	P0	D5	L5		
7	100.5	D4	S3	AF2	C1	D4	S3	AF2	C1
8	47.2	S4	AF4	D2	WB1	D6	S3	AF1	
9	18.9	S7	AF3			S7	AF3		
10	8.9	D4	S4	AF2		D9	S1		
11	13.8	S6	AF4			S8	AF2		
12a	28.5	C3	D3	L2	AF1	D5	L4	C1	
12b	0.9	C3	D3	L2	AF1	D5	L4	C1	
13	81.2	AF3	D2	L2	C2	D4	L4	C1	
14	52.3	D3	AF2	L2	C2	D6	L4		
15	40.9	C4	D3	L2		D6	L4		
16a	33.6	GF3	D3	C2	AF1	D7	C2	GF1	
16b	7.8	AF3	C2	L2	S2	L7	C2	S1	
16c	4.4	GF4	C3	D2	L0	D7	C2	GF1	
17a	23.8	C4	D3	L2	GF1	D6	L3	C1	
17b	2.4	C4	D3	GF2	L1	D6	L3	C1	
17d	1.1	GF4	C3	D2	L0	D7	L1	C2	
17e	1.1	GF4	C3	D2	L0	D7	L1	C2	
18	109.2	C7	L2	D1	S0	C7	L2	D1	S0

TABLE D-7. ESTIMATED SPECIES PROPORTIONS BASED ON STAND LEVEL INVENTORY FOR CURRENT CONDITIONS, HARVESTED AND RESIDUAL FOR ALTERNATIVE D.

Species Code	Proportions		
	Currently	Harvested	Residual
C	35.93	32.08	41.24
D	19.41	18.11	21.18
L	11.00	8.34	14.67
▶	22.40	26.54	16.63
AF	5.66	9.43	0.42
GF	1.06	1.58	0.33
WP	4.55	3.91	5.43
TOTAL	100.00	100.00	100.00

Species codes:
AF - Subalpine fir
C - Western red cedar
D - Douglas-fir
GF - Grand fir
L - Western Larch
P - Ponderosa pine
S - Engelmann spruce
WP - Western white pine
WB - Whitebark pine

TABLE D-8. ESTIMATED SPECIES PROPORTIONS BASED ON STAND LEVEL INVENTORY BY UNIT FOR ALTERNATIVE D. (THE CHARACTER(S) IS THE SPECIES CODE AND THE NUMBER IS THE ESTIMATED SPECIES COMPOSITION IN THE STAND.)

Unit	Acres	Current				After Harvest			
		Spec 1	Spec 2	Spec 3	Spec 4	Spec 1	Spec 2	Spec 3	Spec 4
1	40.3	L5	D3	C2	GF0	L5	D3	C2	GF0
2	11.3	D3	L3	GF3	PP0	D4	L3	GF1	PP1
3	260.4	C4	S2	D2	WP1	C5	S2	D2	WP1
4	39.6	C7	S2	L1		C5	S2	L3	
5	89.2	C3	S3	L2	D2	C4	S2	L2	D2
6a	93.4	S5	AF3	D2	S6	D3	AF1		
6b	22.7	S5	AF3	D2	L0	S6	D3	AF1	L0
7	28.5	C3	D3	L2	AF1	C3	D3	L3	
8	55.8	C9	L1	D0	C7	L3	D0		
9a	0.2	C4	L2	GF2	D1	C4	L3	D2	GF1
9b	23.8	C4	L2	GF2	D1	C4	L3	D2	GF1
9c	5.8	C4	L2	GF2	D1	C4	L3	D2	GF1
9d	4.2	C4	L2	GF2	D1	C4	L3	D2	GF1
10a	11.1	L9	D1			L9	D1		
10b	7.4	L9	D1			L9	D1		
10c	0.4	L9	D1			L9	D1		

Species codes are: AF - Subalpine fir, C - Western red cedar, D - Douglas-fir, GF - Grand fir, L - Western Larch, P - Ponderosa pine, S - Engelmann spruce, WP - Western white pine, and WB - Whitebark pine.

The following codes were used for percent of total stocking: 0 = 0-9%; 1 = 10-19%; 2 = 20-29%; 3 = 30-39%; 4 = 40-49%; 5 = 50-59%; 6 = 60-69%; 7 = 70-79%; 8 = 80-89%; 9 = 90-100%.

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